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SOME BIOCHEMICAL PROBLEMS IN BACTERIOLOGY[1]

THE Society of American Bacteriologists stands, primarily, for pure as distinguished from applied bacteriology. In these days when the applications of the science are becoming so immensely important, and therefore so enticing to the investigator, there is danger that our thoughts turn not often enough to the broader aspect of the science, upon which, as a foundation, all of its applications must ultimately rest. We as a society must make it our special duty to see that these foundations are laid broad and firm, upon the very bed rock of truth itself.

We have as a society been interested for some time in the preparation of standard and uniform methods of describing bacterial species. This is of fundamental importance, leading as it does to uniformity of method and completeness and comparability of results. When we couple with this the use of the standard methods of the laboratory section of the American Public Health Association we have gone a long way toward the standardization of our work, and have begun the foundation upon which can be built the science of pure bacteriology.

But we must ever beware that we become not slaves to standardization and uniformity. It is well enough to proceed by standard methods, but we must not be tied by them. We must ever be ready to abandon the old and adopt the new, when the new marks the way of progress.

[1] President's address before the Society of American Bacteriologists at the Washington meeting, December 28, 1911.

At this time I wish to bring to your attention some of the lines along which we are making little progress, I believe, because of the false security which we are taking in our standard methods.

First, suppose we consider our ordinary culture media. We have drawn up ridiculously exact procedures for mixing and boiling and filtering and titrating our broth, agar and gelatin, and when we are through we believe we have a standard, uniform product. But indeed it is not so. Not only are the results obtained in different laboratories unlike, but two lots of the same medium made at different times in the same laboratory are extremely unlike, when measured by the delicate physiological properties of organisms which respond to the slightest of chemical differences. Far better, it is true, are the results secured at the present time by the use of standard methods, than before their introduction, and I do not for a moment want to decry our standard methods, but I simply want to warn against the false security which their use may give. For however careful we may be in the process, the final result can never be uniform as long as the ingredients used are themselves variable. No medium can be standardized, that is, can be exactly duplicated at another time or place, if it contains such variable materials as beef extract, either freshly made or commercial, peptone, gelatin, agar, blood serum, bile, etc. I am inclined to think that in order to get uniform results, particularly in our study of the delicate physiological properties upon which we depend so largely for the differentiation of bacterial species, the time has come for us to abandon altogether the use of all complex and variable animal and vegetable products, and in their places to substitute materials of definite, known, chemical composition. From my work of the past few years I am led to believe that for every organism it is possible to prepare a synthetic medium containing chemically pure salts, upon which these organisms will grow and grow well. Such a medium as this we are able to duplicate exactly anywhere and at any time.

In the past we have been inclined to think that the physiological properties of many organisms were too variable to be of much use in species determination. I am coming more and more to think that it is not so much the properties of the bacteria which are variable as the environment in which we have attempted to study them. We talk about rejuvenation of organisms to restore them to normal conditions. Our attempts at rejuvenation are attempts to make normal organisms adapt themselves in short order to an abnormal environment. Could we but supply the proper environment we should find the organisms responding in an entirely normal and uniform manner. It is the environment, our culture media, that need rejuvenating and not the organisms. This rejuvenation will come about, I believe, through the adoption of synthetic media of absolutely known chemical composition. Then the physiological properties of organisms will come into their proper place in species differentiation, for then we can substitute the exact qualitative and quantitative tests of the chemist for the inexact determination of the present-day bacteriologist.

There is scarcely a physiological property of the bacteria that is to-day accurately measurable. Variations in the media are so great that measurements at present amount to nothing. Chemistry advanced to its present position as a science only when it became quantitative. Lord Kelvin said: that "When you can measure what you are speaking about, and

express it in numbers, you know something about it; but when you can not measure it, when you can not express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely in your thoughts advanced to the stage of science." Bacteriology must then become quantitative before the real foundations of the science are laid, before it can take its proper place among the sciences. And it can not become quantitative until we can measure its reactions in media of known chemical composition, by methods as exact and definite as any known to the chemist. We are always dealing, it is true, with living protoplasm, but if we place it under definitely determined environment, recent experiments lead us to believe that living substance always responds in a perfectly definite way both qualitatively and quantitatively.

The very complexity of the society's card for the description of bacterial species is to me its own condemnation. It is our admission of ignorance. Are not the real diagnostic characters of a species lost in a maze of unessential characters? Aside from the morphological data, which I believe is all-essential, the cultural and biochemical data could, I am sure, be simplified to a very considerable extent as far as species differentiation is concerned. The forms of cultures and colonies are but functions of the morphology and methods of subdivision of the organisms themselves, as has been so well shown by the recent work of Graham-Smith.[2] We might then eliminate from the card many of the complex descriptions of cultures and colonies on agar and gelatin, retaining perhaps the agar streak and the gelatin stab, and substitute therefore information in regard to their determining factors. And then among the biochemical data if we could eliminate all but a few deep-seated physiological characters which are accurately measurable, and which can be easily determined by means of accurate chemical tests on synthetic media of known composition, we would have a simple, accurate, all-sufficient description of a bacterial species.

One of the weakest parts of bacteriology to-day is its taxonomy. Our methods of classification of bacteria are practically the same to-day that they were in the earliest days of the science. Migula, it is true, systematized the scheme of classification to a certain extent, Chester contributed to its more accurate terminology, and the Winslows gave it a new impetus by the introduction of the methods of biometry. But when we think of the thousands of described species among which but two or three genera are recognized, it must be apparent at once that some of our generic names are seriously overworked. In other biological sciences the classification into species, genera, families, orders, classes, etc., is not only of great convenience, but it also expresses for us something of the relationship of the different groups, something of their probable ancestry and line of evolution. I see no reason why the bacteria should not be classified in the same way. The bacteria are not exceptions to the general biological laws. Variation, selection, heredity, are the factors of evolution here as elsewhere. It is true among the unicellular forms we are free from many of the complications which enter into our discussions of the origin of species among multicellular animals and plants. Sexual reproduction is absent, there is no differentiation into germplasm and somatoplasm to prevent the acquisi-

[2] Graham-Smith, G. S., "The Division and Post-fission Movements of Bacilli when Grown on Solid Media," *Parasitology*, 3, 1910, 17.

tion of new characters, the environment presses very closely upon these unicellular forms and they respond more directly to it. Generation follows generation with startling rapidity, elimination of the unfit proceeds rapidly, the struggle for existence is more severe because of the enormous numbers concerned. In the bacteria we ought almost to be able to see the actual process of evolution since we can place under observation untold numbers of generations as compared with the comparatively few generations of multicellular forms which we are able to observe. Eons of multicellular time are literally compressed into a few unicellular days.

Because of this lack of the regulating influence of reproduction and the greater influence of the environment and the rapidity of reproduction, we might expect to find among unicellular organisms a series of intergrading forms without divisions into groups that resemble the species of higher forms. But this is not so. Among the protozoa differentiation has followed definite lines, and classes, orders, families, genera and species are well marked. The species of protozoa are, for the most part, based on morphological differences, it is true, but among the bacteria a morphological basis of classification fails us. The only morphological differences are the three main divisions as to shape, the round, the rod and the spiral, with slight modifications as to size, arrangement of flagella, formation of spores, chemical composition, etc. But in spite of this lack of morphological basis for classification we find as distinct groups as among the protozoa. As the Winslows say:[3]

> Typhoid germs descend from typhoid germs, tubercle bacilli from tubercle bacilli. The same yellow coccus falls on gelatin plates exposed to the air all over world. The same spore-forming aerobes occur in every soil, the same colon bacilli crowd the intestines of animals and man in every clime. These fundamental types can not be transformed into each other.

And yet to a considerable extent these fundamental types are based not on morphology, but upon physiological differences.

It is among the bacteria that for the first time among living forms we find physiological differences made a basis for classification. Are physiological properties valid criteria for the separation of species? We are accustomed to think of morphological characters as fairly stable, rather difficult to modify, but of physiological characters as easily modified and directly dependent upon the environment. But have we any reason to assume that physiological characters are not deep seated also, are not stable, fully as much as morphological characters? Are we not in reality dealing with characters of the same sort as morphological characters except that we can not see their ultimate basis in structure? I am not sure but what physiological characters are even of greater importance than those of form and external appearance, especially in such simple and undifferentiated forms as the bacteria, since they testify to deep modifications in the chemistry and vital properties of the protoplasm itself. It is upon such chemical properties as these that these simple organisms depend for their very existence, and not upon a modification of external appearance.

But before we can proceed far in the use of physiological differences for species determination we must be able accurately to determine these delicate characters. Hitherto this has been impossible because of the variable and uncertain culture

[3] Winslow and Winslow, "Systematic Relationships of the Coccaceæ," p. 1, John Wiley and Sons, 1908.

media in which we have attempted to study them. With the adoption of media of definite chemical composition for making our determinations and measurements, the physiological characters of the bacteria will assume the importance of the morphological characters of higher organisms. Then and then only shall we able to arrive at a natural classification of bacterial species which shall express for us their true relationship.

With the adoption of such accurate chemical tests of the physiological characters of the bacteria much of the present apparent variation will pass away and we shall find the physiological characters of the different groups as stable as any of their morphological characters. And what little variation remains—and we shall always find some variation as long as we deal with living organisms—we can handle easily by the method of biometry. For, as you know, the methods of statistical variation can apply only in characters which are measurable.

This matter of better methods of species identification and a new taxonomy will be one of the first outcomes of the adoption of simple chemical culture media.

Another important result will be the increased ease with which certain biochemical problems in bacteriology can be attacked. Think for a moment of our endeavors to find a suitable method of isolating the colon bacillus. Litmus-lactose-agar, endo, esculin, neutral red, malachite green, phenol, bile and bile salts and their various combinations are but expressions of our total ignorance of the chemistry involved. The problem should be attacked in an entirely different way. First, we should determine the simplest synthetic medium upon which the colon bacillus will grow rapidly and well. Then by adding to it the chemical body which is the inhibiting agent in the phenol or in the bile we ought to have the ideal medium for colon isolation. A beginning along this line has been made by Dolt[4] in his ammonium lactate, glycerin and malic acid media. But further work must be done until we have a simple synthetic substitute for the complex, variable and inconvenient media upon which we depend so much at present.

And then take the differentiation of the colon and typhoid groups by cultural characters. There must be certain chemical differences inherent in these organisms which could be easily determined by the use of synthetic media adapted to each organism.

Another desideratum is a simple synthetic medium to be used as a substitute for blood serum when used for the diagnosis of diphtheria. We have to depend at present upon the uncertain and unsatisfactory supply of blood from the abattoirs. How much better would it be to find a chemical substitute which would be just as certain for diagnosis and much easier to prepare? I believe that such a substitute will soon be forthcoming.

We have been gradually accumulating a knowledge of a considerable number of important chemical products which are produced by the activities of bacteria either by synthesis or decomposition. Many of these substances are of great importance. Many are produced only as far as we know at the present time by bacteria. How little at present we know of the chemistry of these products! How much can be learned by a study of the formation of these substances in culture media of known composition! The chem-

[4] Dolt, M. L., "Simple Synthetic Media for the Growth of *B. coli* and for its Isolation from Water," *Journal of Infectious Diseases*, V., 1908, 616.

istry of ptomaine and toxin formation, of pigment formation, of enzyme production, may be worked out in this way. The chemist laughs at our present methods of testing the production of gas, the reduction of nitrates, the production of indol, the fixation of nitrogen. And yet when these processes are tested in synthetic media how simple are the chemical tests involved and how accurate may be the results!

Slowly and laboriously the physiological chemist is now trying to work out the chemistry of protoplasm, of the proteins, such as the albumens, the peptones and proteoses. His principal line of attack is by a study of their decomposition products. The brilliant work of Fischer opened up an entirely new field of research when he undertook the study of the synthetic production of the polypeptides from amino acids by an amide link. Still more light might be thrown upon this important problem by the study of the growth of bacteria in simple chemical solutions. For in the synthetic culture medium we would be able to study step by step the synthesis of protein under conditions accurately controlled and completely known. For when bacteria are growing on simple chemical media and are building up untold millions of bacterial bodies from the simple salts present, we can almost see protoplasm in the making.

And finally, aside from the important chemical information which may in this way be obtained, I believe that some most interesting biological information lies along this path. Who would dare to deny that some day it might be possible by some such method as this to discover the secret of the very origin of life itself!

These then are some of the lines of work which appear to me to mark progress in the science of pure bacteriology. Brilliant as may be the results of the study of the applications of bacteriology, fully as interesting, and hardly less important, will be the results that come from the application of exact chemical methods to our at present inexact and rather uncertain bacteriological procedures.

F. P. Gorham

Brown University

THE TEACHING OF MICROBIOLOGY IN COLLEGES OF UNITED STATES AND CANADA[1]

In his admirable presidential address delivered before the Society of American Bacteriologists at the Ithaca meeting in December, 1910,[2] Professor V. A. Moore made a strong argument for bacteriology as a science for general culture as well as for professional value, and a vigorous appeal for better teaching and more carefully developed courses. As a result of this exposition of the subject a committee of this society was appointed to make a systematic inquiry into the teaching of microbiology, including bacteriology, protozoology and the study of the lower fungi, in the educational institutions of the United States and Canada.

The purpose of the inquiry is primarily to learn to what extent bacteriological instruction is given in these institutions, and secondarily to note the character of the teaching in these subjects and the scope of the work. It is possible that as a result of these data submitted the committee may be able to formulate a generally broad and satisfactory plan of instruction in this subject, although this is not the immediate purpose of the committee and it is possible that an attempt to do so would react harmfully in certain instances.

While it is hoped the inquiry will eventually embrace institutions of all ranks, the first report of progress presented at the Washington meeting dealt only with the colleges and

[1] An abstract from the first report of progress by the Committee on Education of the Society of American Bacteriologists.

[2] Science, N. S., Vol. XXXIII., No. 843.

technical schools. These may be classed as follows: (1) The colleges of arts and sciences leading in general to the A.B. or S.B degree; (2) the colleges of agriculture; (3) the colleges of medicine; (4) the technical schools or schools of applied science.

At the outset it should be said that the report on the teaching in these institutions is far from complete, that many schools have not supplied information, and that the following statements form merely the beginning of what, it is hoped, will be a comprehensive and useful study.

The chairman of the committee early in the year prepared a set of questions which were submitted to the other members of the committee for suggestions and desirable changes. These were incorporated in the final list. These questions have been submitted to about 550 institutions of the rank as stated above in the United States and Canada. The collegiate institutions of Canada were not found in any list of the colleges available, but a list was obtained by direct application to the Canadian commissioner of education, to whom cordial thanks are extended. The questions were as follows:

1. What courses in bacteriology, if any, are given in your institution?
2. How many hours of lecture, recitation and laboratory work are devoted to each?
   Lecture
   Recitation
   Laboratory
3. Is the subject a required one, or elective?
4. At what year in the college course is it given?
5. To what group (department) or groups of students is it given?
6. What preliminary training in biological sciences is required?
7. What preliminary training in physics, chemistry, mathematics and languages is required?
8. Is the subject presented as
   (*a*) Part of a course in general biology or botany?
   (*b*) As a general science course for its educational value?
   (*c*) As a special or professional course in applied science?
   (*d*) As a part of any other course? If so, what course and how extensively?
9. If more than one course is given, will you state the scope and character of each, and the approximate number of students in each?
10. If the courses are given from the applied science standpoint, are they given in their relation to
    (*a*) Medicine?
    (*b*) Public health?
    (*c*) Dairying?
    (*d*) Soil and agriculture?
    (*e*) Industrial processes?
11. What is the character of the laboratory work actually performed by the students, *i. e.*, how elaborate experimentation do they actually do?
12. Are the students directed in what might be called research work in bacteriology, *i. e.*, advanced work and investigation, aside from ordinary routine class work?
13. What books do you use as text-books for the course?
    As collateral reading?
14. What courses in protozoology are given?
15. What text and reference books used?
16. What courses devoted to other branches?

Replies have been received from 121 of these and it is on the basis of the replies received up to the present time that the following tabulations and statements are made. A second list of questions has been submitted to those institutions of the original list and supplementary institutions not on the original list from which no replies had been received up to December 21. The failure to reply undoubtedly means in certain instances that no courses are given or that there is no professor dealing with the subject in hand, and consequently letters have failed to be properly received, or there may have been oversights on the part of the professor in charge. Because of the possibility of the second alternative it has seemed desirable to send out the second set of questions.

The replies which have already been received in response to the circular have been of much interest, and careful study may be grouped into a number of tolerably definite classes. In general the replies indicate fairly clearly the scope of microbiological instruction, and in several instances there have been

submitted course schemes showing the exact range of subject matter presented.

On the basis of the study of these replies the chairman has grouped the institutions into several classes which I have characterized as follows:

Group I.—Those institutions in which some phase of the subject of bacteriology is presented very briefly, and in general avowedly from the standpoint of general education, or in connection with courses in general biology, botany or hygiene given from the culture rather than the professional standpoint. Some actual laboratory work is done, however.

In addition there is sometimes an intention to introduce the student to some phase of applied bacteriology in a very brief way. These brief courses vary much in character and extent, and this group is, therefore, the most difficult to classify. A few have made pretentious claims which obviously can not be lived up to in the courses given.

In many of these courses the plan of attack seems to be well thought out, and the relations of lecture and laboratory work is well calculated to give the student a fair general introduction to the whole subject. However, it is only an introduction, and the student product can not be regarded as a trained bacteriologist. On the other hand, some of the courses seem to be badly balanced, to give an undue weight to lectures and too little to laboratory work, and to emphasize some particular and rather narrow phase of the subject.

The institutions which I have included in this group are 39 in number and include for the most part the smaller colleges, or those having no highly specialized courses in applied sciences leading to a professional degree. These courses are apparently sometimes taught by instructors who have had no special or thorough training in bacteriological methods, but who have gained some knowledge of the bacteria, and who have introduced the work in the curriculum because of their personal interest in the subject or their ability to adopt such knowledge to supplement courses already given. In none of these institutions is there any attempt to carry on worthy investigations or research, although in a few of the replies it has been stated that "investigations" are conducted. Examination of the type of research, however, shows it to be trivial and to consist generally in the microscopical examination or plating out of bacteria from a water supply, milk supply or some such simple source. The consideration of this group of institutions can not fail to impress the members of the society with some of the statements made by the president in his address last year, in which he put in a forceful plea for more scientific methods in teaching and more training on the part of those giving instruction in this important subject in many institutions.

Group II.—This group includes institutions having in general but one course or at most two separate courses, but in which work is conducted on broader lines, with more abundant laboratory work and generally in which the teacher is himself a trained worker in some field of bacteriological study and in close sympathy with the subject.

The courses here grouped may in some instances be described as presented primarily for the educational value of the subject as seen in a broad way, and are given from the standpoint of general culture and in the same spirit as that exhibited in the teaching of courses of general chemistry, general botany or general zoology.

Frequently after a fairly broad and comprehensive introduction the work is later restricted to some special phase of bacteriology, as soil, dairy, or sanitary work, so that the subject is actually given with the applied science end in view.

In this group there are undoubtedly some courses which are poor in the sense that they fail to give to the student a broad knowledge of the fundamental principles underlying bacterial behavior and activity. In other words, the biology of the bacteria as a group of living things is frequently subordinated to the examination of water for colon bacilli or the microscopical study of a few restricted types, such as the more common of the pathogens. On the other hand, many of the replies from

institutions which should be placed in this group indicate that bacteriological instruction is on a good foundation, and may be built up with comparative ease when opportunity offers.

In these institutions investigation work of a legitimate character is frequently conducted, and the best of the institutions of this class are contributing valuable work to the sum total of our bacteriological knowledge year by year, through their researches.

I have grouped 22 institutions in this class, in half of which, probably, work of high character is being carried out, while in the others the results do not appear to be so satisfactory.

Group III.—In Group III. I have brought together 28 institutions. In 25 of these, as appears from the catalogues or from subject matter presented in the reports, there is what may be called a well-rounded department of bacteriology or microbiology, with a central fundamental course in general bacteriology. Following this and dependent upon it may be found well organized courses in several of the applied branches, such as soil bacteriology, dairy bacteriology, sanitary bacteriology, fermentation work and medical or public health work. Twenty-five of the twenty-eight institutions here grouped present the breadth of work which I have just described. In three of them the work is organized with a somewhat less broad scope, but it appears to be evident that the work in these institutions is excellent as far as it goes.

Group IV.—In ten institutions, which are almost without exception medical departments or pre-medical courses, the work in bacteriology is arranged with one point in view, namely, to introduce to the student the more common of those types of microorganisms which are the causes of disease. It seems to me that the chief criticism to be made of these courses is that the student loses sight entirely of the important general relations of the bacteria to human welfare and is likely to regard the group simply from the standpoint of disease-production and never from the standpoint of industrial or economic value, or from the standpoint of general culture. In all the institutions of this class, the work is carried out in the graduate department or in the school not connected with the university, and in the former case no serious attempt is made to interest undergraduate men in the subject at all.

Group V.—I have made a separate group for those institutions, schools of engineering, in which a smattering of bacteriology is given to civil or sanitary engineers, in order that they may more properly appreciate sanitary problems. This group is very small, replies having been received from but few institutions. In these the narrowest kind of instruction is given, and the matter is presented in such a way as to leave the impression with the student that deciding upon the sanitary condition of the water supply is a perfectly simple matter requiring no special training. For example, one of the institutions which reports having a class in water bacteriology, states that the number of lectures given in the subject is but four, the laboratory work of the three brief periods and consisting in the examination of but one sample of water and one sample of sewage for the total count and presumptive test for colon bacilli. In the opinion of the writer such courses do positive harm, because they give to the student a false sense of knowledge and ability to decide problems which may be of the utmost importance for the welfare of thousands of people.

The remaining replies may be all grouped in a class together. This includes eighteen institutions. In seventeen of these no real courses in bacteriology are given, although the informants have stated that brief consideration of the subject is taken up in connection with botany, physiology or hygiene. No laboratory work is done, however, and it is evident that these institutions do not require any special consideration. In one of the institutions here grouped, a brief course is given in the examination of bacteria, yeasts and molds, from the standpoint of household economics. The work, however, is very elementary in character.

While it is somewhat disappointing to receive replies from less than one fourth of the

institutions to which the sets of questions were sent, this possibly represents a fairly high proportion of institutions in which instruction in this subject is given. While I am certain that well-defined bacteriological courses are presented in several institutions from which no replies have been received, a survey of the institutions with which I am familiar would lead me to believe that the replies had come probably from a majority of the schools giving bacteriological instruction. From the standpoint of geographical distribution, it seems to be evident that the middle west has done more in the promotion of microbiological education by the installation of courses than has the east or the south. Practically all the central and western state universities and agricultural colleges seem to have well-defined courses, and since these schools occupy very prominent positions in the field of education in the west, it appears to be evident that the student of the central and western part of the country has a greater opportunity to take work in this subject than has the eastern student, who is more likely to attend the privately endowed institutions. New England, with approximately thirty-five colleges and technical schools has, outside of the purely agricultural colleges, but five institutions in which comprehensive bacteriological instruction is given to the candidates for the Bachelor's degree in arts or science. No definite courses are offered in the collegiate department at Harvard, Yale, Dartmouth, Williams, Amherst, Bowdoin, Columbia, Princeton, Pennsylvania or Colgate, and this list could, with a little consideration, be very greatly extended.

It does not seem to the writer that this is the time to suggest methods of instruction, or the exact ground which should be covered in microbiological subjects. It is, however, worth emphasizing that the proper interpretation of bacteriological problems can not be had until the instruction in bacteriology is placed upon a very broad biological and physiological basis, and until there are correlated with such courses training in physics, chemistry and mathematics. These correlated subjects should be of sufficiently advanced character that the student may consider the organisms in their physical, chemical and biometric relations, for it must be admitted that modern bacteriology includes far more than the microscopical examination and cultivation of a few pathogenic types.

Samuel C. Prescott

A BOTANICAL-ZOOLOGICAL LABORATORY IN PORTO RICO

The University of Porto Rico announces that it plans to offer to students facilities for research in botany and zoology in the American tropics.

Special space will be set aside in the agricultural building now in process of erection and the well-equipped physical, chemical, botanical, zoological, bacteriological and plant pathology laboratories may be drawn upon for supplies and apparatus. The research laboratories will be equipped only with the usual essentials, but endeavor will be made to meet special needs, in the way of equipment, which the problems of each student demand.

It is probable that a seaside laboratory, within a few yards of the ocean, will also be provided with needed equipment, including a motor launch for marine collecting, and that a third laboratory will be located on some suitable elevated region. These facilities will be extended to all who are competent to use them and are properly accredited by reputable institutions.

Free tables will be provided for a limited number of advanced students under conditions which will be explained upon communication with the director.

Students who desire to use the laboratories are requested to communicate, as early as possible, to the director, their needs and dates at which accommodation is desired, since there is often delay in procuring supplies.

For the information of prospective students, the following data are given:

Porto Rico lies between 17° 54′ and 18° 30′ north latitude. Geologically it is of much interest, though but little studied as yet. It is extremely rugged and picturesque with its

many volcanic peaks, some rising over 3,700 ft. Caves abound. The climate is delightful and healthful; the nights cool. The mean annual temperature is 76°, the average during the coolest winter month 73°, during the warmest month 79°. The early morning temperature averages 70° in summer, 63° in winter. The average daily maximum is 88° in summer, 83° in winter. The highest temperature recorded on the island last year was 99°. The highest at Mayaguez was 96°. Vegetation is beautiful, distinctly tropical and luxuriant.

The pelagic flora and fauna of the Mona passage are especially interesting. Trawls, dredges, aquaria, etc., will be provided. Fine opportunity is offered for the study of animal and plant anatomy, embryology, physiology, taxonomy, morphology, experimental morphology, ecology, climatic relations and breeding; tropical fauna and flora, marine and land, and problems on geographic distribution and bird migration.

Correspondence of all interested is invited. All who intend to come for summer study, or for other portions of the year, should write several months in advance.

F. L. STEVENS,
Director

SCIENTIFIC NOTES AND NEWS

THE lord provost of Glasgow proposes to convene a conference to promote an international memorial to Lord Lister in Glasgow.

FOR the meeting of the British Association for the Advancement of Science, which is to be held this year at Dundee, beginning on September 4, under the presidency of Professor E. A. Schäfer, F.R.S., the following presidents have been appointed to the various sections: Mathematical and Physical Science, Professor H. L. Callendar, F.R.S.; Chemistry, Professor A. Senier; Geology, Dr. B. N. Peach, F.R.S.; Zoology, Dr. P. Chalmers Mitchell, F.R.S.; Geography, Sir Charles M. Watson, K.C.M.G., C.B., R.E.; Economic Science and Statistics, Sir Henry H. Cunynghame, K.C.B.; Engineering, Professor A. Barr; Anthropology, Professor G. Elliot Smith, F.R.S.; Physiology, Mr. Leonard Hill, F.R.S.; Botany, Professor F. Keeble; Educational Science, Professor J. Adams; Agriculture, Mr. T. H. Middleton.

PROFESSOR CHARLES SEDGWICK MINOT has been selected by the German government as Harvard exchange professor at the University of Berlin for 1912–13. Dr. Rudolf Eucken, professor of philosophy at Jena, has been appointed exchange professor at Harvard University.

DR. WILLIAM T. BRIGHAM, director of the Bishop Museum, Honolulu, has been made a corresponding member of the Imperial Academy of Science, St. Petersburg, and of the Senckenbergische Naturforschende Gesellschaft at Frankfort.

THE following have been elected correspondents of the Academy of Natural Sciences of Philadelphia: Viktor Goldschmidt, Carlotta J. Maury, John Casper Branner and Charles Haskins Townsend.

PROFESSOR W. ODLING, F.R.S., of Oxford University, has resigned the Waynflete professorship of chemistry, which he has held for forty years.

PROFESSOR A. H. PURDUE, who for nearly sixteen years has held the chair of geology in the University of Arkansas, and since 1907 ex-officio state geologist of Arkansas, has been elected state geologist of Tennessee to succeed Dr. Geo. H. Ashley, resigned.

D. W. OHERN, professor of geology at the University of Oklahoma, has been appointed director of the Oklahoma Geological Survey to succeed Chas. N. Gould, who has resigned to enter private work.

MR. MYRON L. FULLER, a geologist on the U. S. Geological Survey, and Mr. Frederick G. Clapp, formerly of the survey, have organized an association known as the Bureau of Associated Geological Engineers with offices in Boston and Pittsburgh.

MR. E. NEVILLE NEVILL, director of the Natal Government Observatory, Durban, is retiring from office, and will in future live in England.

Professor J. A. Gilruth, professor of veterinary pathology in Melbourne University, has been appointed administrator of the northern territory by the commonwealth government.

The Liverpool health committee has recommended the city council to lend the city engineer, Mr. J. A. Brodie, to the government of India for the purpose of assisting in laying out the new capital of India.

President Taft appointed the following scientific men on the recent Assay Commission: Professor John Trowbridge, of Harvard, Professor G. W. Stewart, of the University of Iowa, Professor O. L. Shinn, of the University of Pennsylvania, Professor R. C. Benner, of the University of Pittsburgh, Dr. M. Benjamin, of the Smithsonian Institution, and Dr. L. A. Fischer, of the Bureau of Standards.

The Entomological Society of America has appointed Professor John B. Smith, Rutgers College, Dr. L. O. Howard, chief, Bureau of Entomology; Dr. E. P. Felt, New York state entomologist; Dr. W. M. Wheeler, Harvard University, and Dr. W. E. Britton, Connecticut state entomologist, as delegates to the centennial of the Philadelphia Academy of Sciences, to be held on the 19th, 20th and 21st of March. Professor George Grant MacCurdy will be the delegate from the Paris School of Anthropology.

The anniversary meeting of the Geological Society of London was held on February 16, when officers were appointed as follows: *President,* Dr. A. Strahan, F.R.S.; *vice-presidents,* Professor E. J. Garwood, Dr. J. E. Marr, F.R.S., Mr. R. D. Oldham, F.R.S., and Professor W. W. Watts, F.R.S.; *secretaries,* Dr. A. Smith Woodward, F.R.S., and Mr. H. H. Thomas; *foreign secretary,* Sir Archibald Geikie, K.C.B., president R.S.; *treasurer,* Mr. Bedford McNeill. The following awards of medals and funds were made: Wollaston medal, Mr. Lazarus Fletcher, F.R.S.; Murchison medal, Professor Louis Dollo; Lyell medal, Mr. Philip Lake; Wollaston fund, Mr. C. I. Gardiner; Murchison fund, Dr. A. Morley Davies; Lyell fund, Dr. A. R. Dwerryhouse and Mr. R. H. Rastall.

Dr. Sven Hedin is planning a new expedition to Asia.

An expedition to Newfoundland will be conducted next summer by Professor R. S. Tarr, of Cornell University, to which a limited number of students will be admitted. The geology and physiography of the island will be studied in the field. The party will carry its own camping equipment.

Professor Raymond J. Pool, of the University of Nebraska, has been granted a leave of absence from May 15, in order that he may continue his studies of the vegetation of the Sand Hills of Nebraska. It is planned to extend the detailed work of last summer over a wide territory and into portions of the hills that have never been visited by botanists. Special attention will be paid to the bunchgrass association, to the preparation of vegetation maps and to the vegetation (exclusive of the algæ) of the alkaline lakes which are scattered in great numbers throughout the region. A collection of herbarium specimens will also be made. Professor Pool will be assisted by Mr. Donald Folsom, who is at present the collector for the department of botany in the university.

Dr. David T. Day, of the U. S. Geological Survey, has gone to Vienna, Austria, to attend the meeting of the International Commission of Petroleum Testing Methods.

Professor A. A. Michelson, of the University of Chicago, will give the annual address before the Michigan Academy of Science at Ann Arbor on March 27. His lecture will be on "Iridescent Colors of Birds and Insects."

Professor H. S. Jennings, of the Johns Hopkins University, gave the tenth Hervey lecture at the New York Academy of Medicine on March 2, his subject being "Old Age, Death and the Meaning of Conjugation in Lower Animals."

At the meeting of the Chemical Society at George Washington University on February 15, Dr. Frank Wigglesworth Clark, chief chemist of the U. S. Geological Survey and

professor of mineralogical chemistry at the university, gave an address on the "Composition of the Earth's Crust."

DR. L. A. BAUER, director of the Department of Terrestrial Magnetism of the Carnegie Institution, gave an address on "The Recent Cruise of the Non-magnetic Ship *Carnegie*" at the College of the City of New York on March 1.

THE following lectures have recently been delivered at the University of Missouri under the auspices of the Scientific Association: Professor W. Johannsen, of the University of Copenhagen, February 21 and 22, on "Modern Problems of Heredity"; Professor Albert Bushnell Hart, of Harvard University, February 24, on "America in the Orient."

A LECTURE on sanitation and public health, under the auspices of the department of sanitary engineering of the University of Pittsburgh, was given in Thaw Hall, on March 5, by Professor C.-E. A. Winslow, of the College of the City of New York. This was the third in this series of lectures, the others having been given by Professor Wm. T. Sedgwick and Dr. M. J. Rosenau, respectively. Professor Winslow discussed "Air Supply and the Public Health."

PROFESSOR GEORGE GRANT MACCURDY gave a public lecture in the University Chapel, Columbus, on the evening of March 1 by invitation of the Omega Chapter of the Sigma Xi of the Ohio State University, his subject being "Pre-Columbia Art."

PROFESSOR J. HOWARD MATHEWS, of the department of chemistry of the University of Wisconsin, gave an illustrated lecture on February 7 before the Purdue Chapter of Sigma Xi, at Lafayette, Indiana, on "The Scientific Applications of Color Photography."

UNDER the auspices of the department of geology, Professor Ellsworth Huntington, of Yale University, delivered three illustrated lectures on the general subject of "The Desert" at the University of Michigan, on February 28 and 29 and on March 1. The subjects of his lectures were: "Chinese Turkestan as an Example of the Relation of Deserts to Geological Processes," "Palestine as an Example of the Effect of Minute Differences of Geological Structure upon History" and "Historic Changes of Climate as an Example of the Application of Geological Methods to Historical Problems."

DR. C. L. BABCOCK, of Boston, lectured under the auspices of the department of archeology at Oberlin College on March 5 on the excavations at Cnosis in Crete. Dr. Babcock studied the excavating done by Mr. Arthur Evans, the result of which was the discovery of what is very probably the palace of King Minos, so complicated in detail that it may well have been called the labyrinth. These discoveries have moved back the beginnings of European history well toward 10,000 B.C. The lecture was illustrated with a large number of stereopticon slides prepared by Dr. Babcock himself supplemented by others loaned from the Boston Museum of Fine Arts.

IT is proposed to erect a monument to Dr. J. Janssen, eminent for his work in astrophysics. The officers of the organizing committee are: *President,* H. Poincaré; *vice-presidents,* B. Baillaud and G. Bigourdan; *secretary,* P. Puiseux; *treasurer,* H. Dehérain, Bibliothécaire à l'Institut, Paris, to whom contributions should be sent.

MR. GEORGE MAW, known for his important contributions to botany and other natural sciences, died at Kenley, Surrey, on February 7, aged eighty years.

THE death is announced at Bergen of Dr. G. H. A. Hansen, eminent for the discovery of the bacillus of leprosy in 1871.

M. EUGÈNE CAVENTON, the distinguished chemist and member of the French Academy of Medicine since 1870, has died at the age of eighty-three years.

THE committee on scientific research of the American Medical Association has charge of a small fund which is to be used to promote research. The committee is desirous that this money should be used to meet actual needs and to promote investigative work not otherwise adequately provided for. Applications

for grants are invited. The applicant should state fully the purpose for which the grant is desired; the qualifications of the applicant and the general opportunities and conditions under which the work is to be done. The members of the committee are Ludvig Hektoen, Chicago (1743 W. Harrison St.), Graham Lusk, New York, and Eugene L. Opie, St. Louis, Mo.

Mr. George Henry Verrall, formerly Conservative M.P. for East Cambridgeshire, a former president of the Royal Entomological Society, who died on September 16, left his collection of British Diptera and the cabinets in which it is contained to his nephew, James Edward Collin, conditioned upon his offering to the Natural History Museum, South Kensington, three pairs of each species of which he possessed a full series (six pairs constitute a full series), and at least one pair of each species of which he possessed more than one pair; and all his real and personal estate in the parish of Wicken, Cambs, to the National Trust for places of historic interest or natural beauty.

The Biological Survey of the Agricultural Department has secured the cooperation of the National Zoological Park in experiments in breeding mink for the purpose of ascertaining the possibilities of rearing them in captivity for commercial purposes.

UNIVERSITY AND EDUCATIONAL NEWS

Gifts of over half a million dollars to the University of California have just been consummated, through the deeding of property by trustees for the late Mrs. Jane K. Sather, of Oakland. Plans have been begun for the Sather Campanile, a lofty bell-tower, for which Mrs. Sather provided some $200,000. Two professorships are endowed; the Jane K. Sather chairs in classical literature and history will each have an endowment of approximately $120,000. Endowment is provided for three book funds.

Official record has been made in the city of Philadelphia of the transfer of the new tuberculosis hospital built and endowed by Mr. Henry Phipps to the University of Pennsylvania. The cost of the new building is $300,000, and the entire project will represent an outlay of about $1,000,000.

The Illinois State Supreme Court has rendered a decision which declares unconstitutional an act of the last legislature which voted an item of $60,000 for the medical school of the university. As many of the other acts of the legislature were passed in the same manner, there is considerable confusion in the minds of people as to what the outcome may be. It is thought that a special session of the legislature may be called to straighten out affairs.

The departments of horticulture and plant pathology of the University of Wisconsin have moved into their new building. It is a two-story and basement brick structure, 48 by 128 feet, and with attic space for laboratories. The cost of the building was $60,000, exclusive of the four greenhouses, potting house and pathologium, situated in the rear of the building. In the basement of the new structure are spray laboratories, fruit rooms and bulb rooms, while the offices, lecture rooms and general laboratories of the horticulture department are on the first floor. The second floor is given over to the plant pathology department, under Professor L. R. Jones. Professor J. G. Moore is at the head of the horticulture department.

The royal commission on university education in London has recommended a building for the university to be placed on a vacant site of more than 100,000 square feet immediately behind the extension of the British Museum. The site consists of four plots, two on each side of the new British Museum Avenue, on one of which it is proposed that a spacious hall should be built for the university, the other three plots being used for administration, library, small lecture theaters and rooms for graduates. The site is part of the Bedford estate, and it is stated that the Duke of Bedford is prepared to dispose of it for the purposes suggested.

Dr. Arthur Holmes, assistant professor of psychology at the University of Pennsylvania,

has accepted the post of dean of the faculties of Pennsylvania State College.

THE following appointments have been announced for the medical department of the University of Pennsylvania: Dr. Edward Lodholz is to be assistant professor of physiology; Dr. W. N. F. Addison, assistant professor of normal histology; Dr. George H. Fetterolf, assistant professor of anatomy; Dr. L. A. Ryan, assistant professor of chemistry and toxicology.

DR. E. T. WHITTAKER, F.R.S., royal astronomer of Ireland, has been appointed professor of mathematics in the University of Edinburgh, in succession to the late Professor Chrystal.

DISCUSSION AND CORRESPONDENCE

REPLY TO HOLMES'S CRITICISM OF "LIGHT AND THE BEHAVIOR OF ORGANISMS"

IN a review of the book entitled "Light and the Behavior of Organisms," which appeared in this Journal, June 23, 1911 (pp. 964–966), the author raised several points that call for elucidation. Before entering upon the discussion of these points, however, I wish to take this opportunity to state my regret in having overlooked the work of several investigators bearing on some of the subjects treated, especially that of R. S. Lillie on the reactions of *Arenicola* larvæ, to which Holmes calls attention.

After referring to the numerous attacks made in the book in question, on Loeb's theories of orientation, Holmes says (p. 964):

> Mast's own investigations seem to afford about as good support as has been furnished for the theory which he so persistently attacks.

He then gives two cases in support of his contention:

> 1. No clearer case of orientation through the local response of the part directly stimulated could well be imagined than the one afforded by *Amœba*, and the author admits that the "method of orientation is in harmony with much in Verworn's theory and also with the essentials in Loeb's." But he adds that "it does not, however, support the idea connected with these theories, that a constant intensity produces a constant directive stimulation." I am not sure that I understand the pertinency of the criticism, for there is nothing in the theories of either of these writers which implies that the actual stimulating effect of any directive agency is subject to no variation.

2. Referring to orientation of *Arenicola* larvæ he says (p. 965):

> Orientation in this form is apparently as automatically regulated an activity as one might expect according to the well-known theory of Loeb.

The point at issue here clearly concerns the question as to whether the methods of orientation in *Amœba* and *Arenicola*, as described in my book, are in accord with Loeb's theories of orientation. To settle this question it is of course necessary first of all to understand these theories. I say theories, for, contrary to my critic's assumption, there are three instead of one, as pointed out in my book, pp. 23–35, especially in the summary (p. 54) where the following statement is found:

> In 1888 Loeb held that orientation in animals is controlled by *the direction in which the rays of light pass through the tissue.* From 1889 to 1903 he advocated the idea that orientation is controlled by the *direction in which the rays strike the surface, or the angle they make with the surface.* His statements from 1906 to 1909 indicate that he thinks that orientation is regulated by the *relative intensity of light on symmetrically located sensitive structures on opposite sides of the organism.*

The idea that orientation is the result of continuous action of light is common to all of these theories and is undoubtedly their most important distinguishing characteristic. Loeb has repeatedly stated this in unmistakable terms. Witness, *e. g.*, the following statement found in "Dynamics of Living Matter" (p. 135): Heliotropism is "a function of the constant intensity," and the same idea expressed more fully in the same publication on pp. 117–119, 130–131, 138–139. My critic has evidently failed to grasp this idea in spite of the fact that I have repeatedly stated it in different forms in quotations from the references just given and others, indeed even to such an extent that one of my reviewers objects to the repetition as superfluous.

In order to show that an organism orients in accord with Loeb's theories it is conse-

quently necessary to prove that the response is due to "constant intensity," *i. e.*, that the orienting stimulus acts continuously and is not due to changes of intensity. This I have been unable to do in any case whatsoever in spite of persistent efforts, and as far as I am aware it has never been done. It was owing to this that I made the statement that the orienting reactions in *Amœba* do not support the idea connected with the theories of Loeb and Verworn that "a constant intensity produces a constant directive stimulation" quoted by Holmes. His failure to "understand the pertinency of this criticism," as he says, indicates that he did not understand these theories.

The second case which Holmes cites in support of his contention that my investigations lend support to Loeb's theories shows even more clearly than the first that he did not understand these theories. After admitting that in case of the orientation in *Arenicola* larvæ "the question remains open whether the stimulus is produced by the direct action of light on the sensitive surface of the animal or by changes in intensity of the stimulus caused by the lateral movements of the body" he maintains that orientation in these animals is in accord with "the well-known theory of Loeb" because it is "*apparently automatically* . . . regulated" (italics mine). Thus admitting that it can not be proved that orientation is due to continuous stimulation, he would make automaticity the criterion of Loeb's theories, ignoring all other distinguishing characteristics found in them.

It is true that Loeb often uses the term automatic in discussing reactions which he calls tropisms, but what does it mean? Automatic means mechanically self-acting, that is, involuntary. In accord with this definition are there any reactions whatsoever in *Arenicola* or in any other organism below man which are not automatic? Investigations and speculations without end have been directed toward the solution of this very problem and yet there are few bold enough to say that it has been solved for even a single case. Of what possible value then can automaticity be as a distinguishing characteristic of a group of reactions supposed to be specific, and what bearing can the statement that the orienting reactions of *Arenicola* larvæ are *apparently automatic* have on the mechanics of orientation (tropisms) of this or any other organisms?

It is precisely such loose and uncritical statements as Holmes has made regarding Loeb's theories with the suggestion of such impossible criteria as automaticity that have brought the discussion centering around the term "tropism" to the chaotic condition in which it is found at present. To show that a reaction is in accord with any one of Loeb's three theories it must of course be demonstrated that it is in harmony with all of its characteristics, not merely with one of them, as my critic seems to imply. It must be proved, among other things, as demonstrated above, that the external stimulating agent acts continuously in the process of orientation. Until this is done Loeb's statement that orientation is a function of the constant intensity must be classified as anthropomorphic speculation. And if the statement of my critic is true, that my investigations afford about as good support as has been furnished for Loeb's theories, it is evident that they rest on extremely nebulous foundations. If Holmes can produce a single case in which he can prove that orientation occurs in accord with any of these theories I trust that he will do so in answer to my reply to his criticism.

My discussion concerning certain theoretical views held by Jennings brings out the most caustic criticism that Holmes has to offer. He quotes the following paragraph from my book:

> Every step in the development of the theory [Jennings] is supported by numerous experimental facts and all seems to fit what is known concerning the reactions of organisms. Reactions, according to this theory, are, as stated above, primarily due to physiological states. External agents ordinarily produce reactions through the effect they have on these states. By the application of this idea all the different phenomena connected with reactions to light as summarized at the beginning of this chapter can be accounted for.

This quotation is followed by a paragraph containing the following sarcastic remarks (p. 966):

> It would indeed be comforting to be able to repose with such a spirit of confidence and contentment in a general philosophy of behavior, but it is perhaps pertinent to enquire if the author has not been deceived with the delusive appearance of explanation where no real explanation has been given. . . . Phenomena may thus be "accounted for" on the basis of varying internal states, but as it is admitted that in most cases we are entirely ignorant of what these states are we are about as much enlightened as we are by the celebrated explanation of the sleep-producing effect of opium by attributing it to a dormitive principle.

If I had said nothing more than is contained in the paragraph which Holmes quoted from my book there might be some excuse for such criticism, but the very sentence following this paragraph reads:

> But what are these physiological states and of what do they consist? That there are such states in organisms can not reasonably be doubted, and that the reactions are dependent upon them much as Jennings assumes, seems to me to have been well established in his work. But what regulates the physiological states is a question concerning which we have as yet but little knowledge.

The two pages in my book following this quotation are devoted to an attempt to illustrate the limitation of Jennings's ideas, and it is concluded (p. 375):

> For all that is known to the contrary, subjective factors, entelechies, or psychoids, factors foreign to inorganics, may have a hand in controlling physiological changes and consequently the reactions. Such factors have been postulated by the vitalists and neovitalists, notably by Hans Driesch.

I am at a loss to know how my critic could have read even superficially these statements and the argument connected with them and still conclude that I had been deceived with the delusive appearance of explanation where no real explanation has been given. I am not certain what Holmes means by a real explanation, but I am certain that neither Jennings nor I has ever even so much as intimated that the demonstration that reactions of organisms are dependent in a definite way upon internal states constitutes a complete explanation of behavior. In the paragraph which Holmes singled out for attack with reference to this question I did not even use the term explanation, merely stating that the reactions could be "accounted for" by the application of certain ideas regarding internal states. Thus it is evident that his caustic criticism is directed not toward anything actually stated, but toward an imaginary implication.

However, to intimate as Holmes does in the second quotation given above, that a demonstration of the actual value of internal factors in behavior is useless because it is not known precisely what the internal factors are, is expressing a principle which if applied generally would at once do away with scientific investigation, for is it not well known that science in all of its aspects rests upon phenomena which are clothed in mystery? A scientific explanation, as I see it, consists of a demonstration of the order of events involved in the phenomenon. The demonstration that in the observed phenomena known as behavior events within the organism occur in a certain order in the whole series of events ending in these phenomena (behavior) is as truly an explanation as any we have in science. It is one step in the series, even if only a small one, which, as far as can be predicted at present, leads back into the unknown without end.

I can understand the statements of Holmes in his criticisms only on the assumption that he reviewed my book hurriedly and carelessly. As evidence of this we have not only his erroneous conceptions regarding Loeb's definition of tropism and his failure to grasp my ideas in the discussion of the theoretical views of Jennings, but also the fact that in his short quotation from my book there are three changes from the original. Moreover, his statement (p. 965) that I have presented "no discussion of any theoretical attempt to explain the reversal of phototaxis" is not true, as reference to page 370 will show.

S. O. MAST

JOHNS HOPKINS UNIVERSITY

SCIENTIFIC BOOKS

Commercial Geography. By Albert Perry Brigham. Boston, Ginn & Co. 1911. 28 chapters, 449 pages, 17 colored maps and 253 illustrations. $1.30.

This latest addition to the texts of commercial geography will very rapidly prove its worth because of the practical pedagogic principles followed in the arrangement and presentation of the material.

The great raw materials of world-wide interest and of vast significance in the commercial world are concretely presented, as Part I., in a series of chapters on wheat, cotton, cattle, iron and coal. A study of the activities centered about each of these great raw materials gives the student a broad outlook and furnishes a basis for Chapter VI. on the Principles of Commercial Geography. The discussion of raw materials before the considerations of the geographic principles will be welcomed by educators as far superior to the usual broad generalizations concerning a conglomerate hodgepodge of land forms, climate, rivers, lakes, raw materials, transportations and industry. Chapter IV. on Iron is typical of the method in which this text presents all of the five great raw materials. This chapter has excellent views, diagrams, maps and graphs.

The five types of raw materials are followed by the discussion and application of the principles to the United States which forms Part II. of the text. This presents in eleven chapters the physical features; plant, animal and mineral industries; water resources; transportation; commerce; centers of general industry and the concentration of industries. The space given to the United States is more than the average text, but this added emphasis is in accord with the general movement among educators to require from students a better understanding of our own country. The maps of production are especially clear and are constructed so that a comparison of various states and regions is very easy. The water resources of the United States is a chapter not generally considered in a commercial geography, but it makes a most valuable addition. The concentration of industries and the centers of general industry is another innovation which is most heartily endorsed by instructors as excellent material well designed for instruction in modern commercial geography.

The foreign countries receive a brief but ample discussion for high school students. In each of the countries the proper emphasis is given the predominant industry of each individual country. The final chapter on World Commerce is an excellent application of the geographic principles which have been developed in the previous sections of the text.

In the writer's opinion this text has many points of superiority which greatly strengthen the instruction in commercial geography.

W. M. Gregory

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SOME EARLY PHYSIOGRAPHIC INFERENCES

The inferences of early travelers as to the physiography of a region are always interesting if the traveler is a good observer. The following references may not be new to some geologists, but they were new to the writer and seem worth publishing.

Wm. Darby in his "Emigrant's Guide," 1811, states that one of the branches of the St. Francois River "appears to have been an ancient outlet of the Mississippi" (page 139). Apropos of the same region, James Hall in his "Notes on the Western States," Philadelphia, 1838, says "About midway between St. Louis and the mouth of the Ohio, masses of limestone rock are seen on either side, which, though now unconnected, have the appearance of once having formed a continuous ridge crossing the river in an oblique direction" (page 47). Both these travelers, in looking across the southeast lowlands of Missouri, inferred general truths that, taken together, would form important links in the history so admirably worked out nearly a century later by Professor C. F. Marbut.[1]

[1] "The Evolution of the Northern Part of the

As Darby infers, the Mississippi formerly flowed west of its present channel. It was separated from the Ohio by an interfluve, the remnants of which are the "continuous ridge" mentioned by Hall. By two successive captures the Ohio diverted the Mississippi; the final capture led the Mississippi through its present gorge where the "masses of limestone rock are seen on either side."

Henri Peyroux de la Condreniere, commandant at Ste. Genevieve from 1787 to 1796, was a man of considerable scientific ability. In one of his essays he maintains that the Great Lakes formerly discharged into the Mississippi by way of the Illinois River. He reasons that the valley is too wide and deep to have been eroded by the present Illinois River. Another reason quoted is not so well founded; the "vast alluvium" stretching along the Mississippi to the Gulf is also held to indicate a drainage from the Great Lakes. This conjecture is an interesting prelude to the work which has shown the extent and drainage of those great marginal glacial lakes that preceded the present Great Lakes. The quotation has been handed down by Brackenridge, the lawyer-traveler in his "Recollections of the West," second edition, Philadelphia, 1868 (page 241). He (Brackenridge) adds prophetically "At no distant day the labor and ingenuity of man will restore the connection between the Lakes and the Mississippi by means of an artificial channel."

F. V. EMERSON

UNIVERSITY OF MISSOURI

SPECIAL ARTICLES

HORNS IN SHEEP AS A TYPICAL SEX-LIMITED CHARACTER[1]

SEVERAL years ago Wood (1905) published a note in which he showed that, in a cross between a Dorset Horn and a Suffolk (belonging to a hornless breed of sheep), the male offspring all developed horns but the female offspring remained hornless. He showed further that in the F_2 generation hornless males arise, and these do not carry the determiner for horns, and horned females, but only when they have the determiner duplex. Bateson (1909, p. 173) has discussed these facts and drawn the conclusion: "Sex itself acts as a specific interference, stopping or inhibiting the effects of a dominant factor, and it is not a little remarkable that the inhibition occurs always, so far as we know, in the female, never in the male." He admits, however, the difficulty in distinguishing between this probability and the other possibility; viz., that the male provides a stimulating factor. Castle (1911, p. 102) concludes that the reason horns are more strongly developed in males than females is "the presence of the male sex-gland in the body, or rather probably some substance given off into the blood from the sex gland, favoring growth of the horns"; and he adds that if the male Merino sheep (in which, usually, the male, and the male only is horned) is castrated early in life no horns are formed. He gives no reference for the last statement; and in view of the variability of the horned condition in the males of the "Merinos" the conditions of the experiments would have to be carefully considered before such a result could be accepted as settling the question of the dependence of horns in heterozygous males upon a secretion from the testis.

The hypothesis that we have adopted and which works with entire satisfaction assumes, first, that, as in man so in sheep, the male is heterozygous (simplex) in sex. One sex-chromosome is then to be expected in the male, and substantially this condition has been found to hold for man by Guyer (1910). The female will then be duplex in respect to sex. One further assumption is necessary; there is an inhibitor to horn formation, and this is located on the sex chromosome; consequently it is simplex in the male and duplex in the female. Thus it belongs to the well-known class of sex-limited characters. The inhibi-

Lowlands of Southeast Missouri,'' University of Missouri Studies, Vol. I., No. 3, 1902.

[1] Joint contribution from the New Hampshire Agricultural Experiment Station and the Station for Experimental Evolution, Carnegie Institution of Washington.

Determiners in Germ Plasm of			No. of Horned and Hornless Offspring			
			Males		Females.	
	Male	Female	Horned	Hornless	Horned	Hornless
Soma	*XxhhIi* (hornless).....	*XXhhII* (hornless)				
Gametes	*XhI*.....	*XhI*				
	xhi					
Zygotes	*XxhhIi* (hornless).....	*XXhhII* (hornless)	0	4	0	12
Soma	*XxhhIi* (hornless).....	*XXHhII* (hornless, simplex)				
Gametes	*XhI*.....	*XHI*				
	xhi.....	*XhI*				
Zygotes	*XxHhIi* (horned).....	*XXHhII* (hornless)	(2)	(2)	(0)	(2)
	XxhhIi (hornless).....	*XXhhII* (hornless)	2	2	0	2
Soma	*XxhhIi* (hornless).....	*XXHHII* (horned)				
Gametes	*XhI*.....	*XHI*				
	xhi					
Zygotes	*XxHhIi* (horned).....	*XXHhII* (hornless)	15	0	0	24
Soma	*XxHhIi* (horned, simplex).....	*XXhhII* (hornless)				
Gametes	*XHI*.....	*XhI*				
	XhI					
	xHi					
	xhi					
Zygotes	*XxHhIi* (horned).....	*XXHhII* (hornless)	(.5)	(.5)	(0)	(8)
	XxhhIi (hornless).....	*XXhhII* (hornless)	0	1	0	8
Soma	*XxHhIi* (horned, simplex).....	*XXHhII* (hornless, simplex)				
Gametes	*XHI*.....	*XHI*				
	XhI.....	*XhI*				
	xHi					
	xhi					
Zygotes	*XxHHIi* }	*XXHHII* (horned)				
	XxHhIi } (horned).....	*XXHhII* }				
	XxHhIi }	*XXHhII* } (hornless)	(7.5)	(2.5)	(2)	(6)
	XxhhIi (hornless).....	*XXhhII* }	6	4	1	7
Soma	*XxHhIi* (horned, simplex).....	*XXHHII* (horned)				
Gametes	*XHI*.....	*XHI*				
	XhI					
	xHi					
	xhi					
Zygotes	*XxHHIi* (horned).....	*XXHHII* (horned)	(10)	(0)	(4)	(4)
	XxHhIi (horned).....	*XXHhII* (hornless)	10	0	4	4
Soma	*XxHHIi* (horned).....	*XXhhII* (hornless)				
Gametes	*XHI*.....	*XhI*				
	Hhi					
Zygotes	*XxHhIi* (horned).....	*XXHhII* (hornless)	5	0	0	8
Soma	*XxHHIi* (horned).....	*XXHHII* (horned)				
Gametes	*XHI*.....	*XHI*				
	xHi					
Zygotes	*XxHHIi* (horned).....	*XXHHII* (horned)	6	0	14	0

tor, then (designated in the table by the letter *I*, its absence by *i*), will always be double in the female and single in the male and, in the gametes, will always be associated with the sex-chromosome, which is designated throughout by the symbol *X*; its absence by *x*. In the zygote the single inhibitor is incapable of preventing the development of the determiner for the horn (*H*) even when the latter is only simplex. But the double inhibitor is capable of preventing the single horn (*Hh*) determiner, but not the double determiner (*HH*).

The table gives a summary of matings used, their hypothetical somatic and gametic composition, and the proportion of each sort of zygote that will be formed in each sex.

The actual frequency of offspring derived from each mating is given on the left of the table; the expected proportions in the more complex cases being given above the actual findings in parenthesis. The matings were made and the offspring examined in major part at the New Hampshire Agricultural Experiment Station and in minor part at the Station for Experimental Evolution. The latter station was able to contribute especially to the results of later generations. For horned females, Dorsets were used; for horned males Rambouillets, Dorsets and the Scottish 4-horned race. As hornless races the Downs were chiefly employed. It is not our purpose now to give complete details, as the experiments are being continued and full data will be deferred until the publication of our final report.

The results of the table accord very closely with expectation, so that we are justified in concluding that an explanation of the results like that we offer is the correct one. By our formula, then, the case of inheritance of horns in sheep is brought quite into line with that of other sex-limited characters, its peculiarities being due to an inhibitor of horn development that is carried in the sex-chromosome.

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T. R. ARKELL,
C. B. DAVENPORT
DURHAM, N. H.,
COLD SPRING HARBOR, N. Y.,
January 29, 1912

THE "STOMACH STONES" OF REPTILES

GASTROLITHS have been known to occur, mingled with the remains of extinct reptiles, for many years and much attention has been called to them in the pages of SCIENCE and elsewhere, especially by Mudge, Seeley, Williston, Eastman, Wieland and Brown. Interesting parallels have been cited among several living vertebrates. There has been some contention that the stones were taken for the purpose of a "gastric mill," but they were in part at least accidental. There seems to be some evidence for the conclusion that the plesiosaurs, at least, selected stones for this purpose, though this may have been more accidental than we think. Recently there has been brought to my attention by Mr. Edward Taylor, of the University of Kansas, an interesting case of stone swallowing by a lizard, *Phrynosoma cornutum* Harlan. Only a single specimen is at hand for the data, but it is of sufficient interest in connection with identical habits among fossil reptiles to be recorded. The horned "toad" in question is a very large adult female collected by the late Dr. F. H. Snow in the Magdalen Mountains of New Mexico. In the stomach were twenty large, somewhat abraded stones of a rock which resembled lava. Some of the stones are very large, for the size of the animal, measuring nearly a third of an inch in diameter. There were also in the stomach about 200 of the large red ants, of an undetermined species, which make the large mounds so common to the western traveler. The animal had undoubtedly picked up the stones with the ants from the top of the mound and the association is probably accidental. That they served the purpose of a "gastric mill" once inside the digestive canal can not be doubted, whether the animal willed or no.

In this connection it may be of interest to the readers of these pages to call attention to some large Cretaceous sharks which have, within the past few months, been received at the University of Kansas Museum. In one specimen, consisting almost entirely of scattered vertebral cartilages, there are associated many hundreds of greatly abraded, very smooth and polished stones of white and black quartzite. That they belong with the shark can not be doubted on account of the

association. The pebbles resemble to a great extent those figured by Dr. Williston some years ago as occurring with a pleisosaur. Another, nearly complete skeleton of a large shark, *Isurus mantelli* Ag., has preserved the larger part of the cranial cartilages. The sharks will shortly be described in detail and further reference need not be made to them here.

Roy L. Moodie

The University of Kansas,
January 26, 1912

THE WASHINGTON MEETING OF THE AMERICAN CHEMICAL SOCIETY[1]

The meetings of the society were held from Wednesday, December 27, to Saturday, December 30.

On Wednesday morning four papers were presented in joint session of the Section of Chemical Education and the Division of Physical and Inorganic Chemistry:

A. A. Noyes (chairman): *The Teaching of Physical Chemistry.*

W. D. Bancroft: *Physical Chemistry in the Introductory Course.*

In the introductory course we should include: gas law; boiling-point curve; solubility; a brief statement of the dissociation theory; qualitative mass law, and qualitative catalysis. We should exclude: quantitative mass law; dilution law; solubility product, and reaction velocity. I am doubtful about electrolysis and osmotic pressure; but I should include the former and exclude the latter.

H. C. Jones: *The Introduction of Physical Chemical Conceptions in the Early Stages of the Teaching of General Chemistry.*

J. Howard Mathews: *Some Applications of Color Photography in the Teaching of Physical Chemistry.* (Illustrated.)

The theory and manipulations of the "screen-plate" processes of color photography were described briefly. Numerous scientific applications of color photography were pointed out, and each application was illustrated by color photographs thrown on the screen. The process has been found to be exceedingly useful in photographing interference figures and in recording the interference colors observed when certain crystals are viewed in polarized light. In many of the slides illustrating the latter, selenite plates were used to produce backgrounds of strong contrast and brilliant color. Photographs of "thin-sections" of various rocks showing their characteristic appearance in polarized light were also shown. The process has been found to be particularly well adapted to the projection of spectrum charts, etc., in colors. The absorption bands of chlorophyll were photographed directly in the spectroscope and a fairly accurate record obtained. Pure spectrum colors are not truly rendered by the process, since the color is always dependent on the dyes used to color the starch grains. However, an attempt to photograph the fluorescence of solutions of fluorescein met with considerable success.

The following three papers were presented in general meeting on Wednesday afternoon:

President Frankforter (Section C): *The Resins and their Chemical Relations to the Terpenes.* To be published in Science.

H. P. Talbot (chairman Division of Physical and Inorganic Chemistry): *Privileges and Responsibilities of the Chemical Analyst.*

A. L. Voge: *Ostwald's Proposed International Institute of Chemistry (chiefly bibliography and library practise).*

On Thursday evening two addresses were given in general session:

Alexander Smith (president American Chemical Society): *An Early Physical Chemist.* Published in the issue of Science for February 1.

Frank B. Kendrick and H. E. Howe: *Lantern Experiments on Reactions in Heterogeneous Systems.*

A series of lantern illustrations of the effect of temperature, pressure, concentration, surface, osmotic pressure, etc., on reactions in heterogeneous systems. Several adaptations of a Bausch and Lomb balopticon were described, including a modification of the Töpler "Schlieren" apparatus for projection and the use of the lantern as a photographic camera.

On Friday a symposium on Mineral Waters was held before the Division of Industrial Chemists and Chemical Engineers. Titles of papers presented before this important symposium were published in Science of January 12. The papers themselves together with the voluminous discussion will be featured in the March issue of the *Journal of Industrial and Engineering Chemistry.*

[1] Most of these papers will be published in the *Journal of the American Chemical Society* or in the *Journal of Industrial and Engineering Chemistry.*

The following papers were presented before the various divisional meetings:

DIVISION OF AGRICULTURAL AND FOOD CHEMISTRY

H. E. Barnard, *chairman.*

B. E. Curry, *secretary.*

H. E. BARNARD (chairman's address): *A Study of the Pollution of the Ohio River Bordering Indiana.*

During the summer of 1911, the Indiana State Board of Health made a comprehensive study of the condition of the Ohio River bordering Indiana. A chemical and bacterial laboratory was fitted up in a house boat in which samples taken each mile were analyzed. The chemical analysis included the estimation of nitrates, the estimation of nitrites, the estimation of chlorine, of oxygen consumed, the estimation of dissolved oxygen, the estimation of alkalinity and turbidity. The bacterial analyses: an estimation of the number of bacteria; the presumptive test for *B. Coli* and the differential test for *B. Coli* on every tenth sample.

The work, which extended over three months, established new data on the purification of flowing streams and is a valuable contribution to the knowledge of the character of the Ohio River. The report will not be completed for publication until the spring of 1912.

W. A. WITHERS and F. W. SHERWOOD: *A Modification of the Tiemann-Schulze Method.*

B. L. MURRAY: *Determination of Small Amounts of Caffeine—A Comparison of Methods.*

The author has compared the results obtained by the method of Görter and by that of Lendrich and Nottbohm, using coffee and coffee preparations as samples. It is shown that when only small amounts of caffeine, particularly when less than 0.5 per cent., are present the Görter method yields results 50 to 100 per cent. higher than those of the Lendrich and Nottbohm. The author believes the Lendrich and Nottbohm method preferable. About fifty analyses are tabulated, each with duplicate results.

W. H. ROSS and RAYMOND C. BENNER: *The Filtration of Soil Solutions. A New Filter for This and Similar Purposes.*

FERNAND BRUNSCHWIG: *The Presence of Lead and Copper in Cream of Tartar and Tartaric Acid. Technical Methods to Purify these Products.*

J. B. BATHER: *The Forms of Phosphorus in Cotton-seed Meal.*

J. F. SNELL: *An Electrical Conductivity Test for Purity of Maple Syrup.*

The syrup is diluted with two volumes of water and the electrical conductivity measured at 25° C., with a Wheatstone bridge and telephone in the customary manner. The specific conductivity multiplied by 100,000 gives the "conductivity value." The test is simple and rapid.

Among 57 samples of genuine syrups from Quebec, Ontario and Vermont, only two samples (these two not market syrups) give conductivity values over 200. The minimum value found was 110, the syrup giving this being the one prepared under the supervision of the Vermont Agricultural Experiment Station, under such conditions as to give the malate of lime every opportunity to settle out. Values less than 120 were given by only 3 samples—all very light colored, high-quality goods. Genuine syrups may, therefore, be expected to give values between 100 and 200—Canadian syrups ordinarily between 120 and 200.

Syrups compounded of maple syrup with over 50 per cent. of its weight of an equally dense syrup made from granulated cane sugar give values below 100. Imitation syrups made from granulated sugar and artificial maple flavors give still lower values. Such gross adulterations with refined cane sugar are immediately indicated by this test.

JOHN STEWART: *A Brief Study of the Phosphorus Associated with the Matière Noire.*

This paper attempts to answer the question: Is the phosphorus in the *Matière Noire* organic or inorganic? Treatment of the soil with NH_4OH fails to extract any phosphorus. Partial removal of acid soluble phosphorus and complete removal of acid soluble phosphorus, followed in each case with NH_4OH extraction, gives ammoniacal solutions with practically identical phosphorus content; viz., approximately 0.0103 per cent. on soil. The conclusion is that all the phosphorus associated with the *Matière Noire* is organically combined. Practically all the iron and aluminum present in the *Matière Noire* are organic. Hydrolysis takes place during extraction with alkali and a large part of the phosphorus and some iron and aluminum are converted into inorganic forms.

Several precipitating reagents for separating inorganic phosphorus from organic were tried; but results were unsatisfactory.

EMMA CRANDAL: *The Composition of Free Oyster Liquid.*

Present data on the composition of the oyster is meager. The author has endeavored, by a

study of oysters and oyster liquor purchased in the open market, to establish factors which will be helpful in showing whether or not oysters have been floated or watered in transit. This she does by a study of the total solids, ash nitrogen, chlorine of both the free liquor and oyster meats and calcium content, immersion refractometer reading. The data obtained are not conclusive and further work is proposed in the hope that it may be possible to establish definite factors of composition.

H. E. Bishop: *New Data on the Composition of Prepared Mustards.*

Prepared mustard is a paste composed of ground mustard seed with salt, spices and vinegar and should conform to certain standards of composition. The author, in the course of a study of prepared mustards, finds that they vary greatly in character. He has endeavored by determining certain factors, namely, total solids, ash, sodium chloride, acidity, starch, crude fiber, protein, etc., to gather data of value in determining whether prepared mustards are pure or adulterated. The author finds a great variation in composition. The data at hand are as yet inconclusive. Further work is proposed in the hope that new data, throwing additional light on the composition of mustards, will be forthcoming.

J. M. Price: *A Method for the Separation of the Seven Coal-tar Colors when Occurring in Mixtures.*

L. H. Smith: *Altering the Composition of Indian Corn by Seed Selection.*

In 1896 the Illinois Agricultural Experiment Station began experiments with a variety of corn to alter the chemical composition of the corn by seed selection. Fourteen years of breeding have produced the following results: The protein content has been increased from 10.92 per cent. in the original, to 14.87 per cent. in the crop of 1910. At the same time by selecting in the opposite direction, the protein has been decreased to 8.25 per cent.

Even more striking changes have been produced in the oil content. In the original corn the percentage of oil was 4.70. After fourteen years selection for high oil a strain has been produced which carried 7.72 per cent., while the corresponding selection for low oil has resulted in a strain which contains 2.11 per cent.

J. F. Breazeale and J. A. LeClerc: *Influence of Reaction of Culture Medium on Root Development of Wheat Seedlings.*

J. A. LeClerc and B. R. Jacobs: *The study of True and Imitation Graham Flour.*

C. C. Moore: *The Desiccation of Potatoes and the Uses of the Product.*

The desiccation of potatoes has been commercially developed in Germany, but the product has not been suitable for the manufacture of starch. Investigations have shown that a dried potato product can be prepared in a way suitable for starch manufacture. Owing to the greater degree of fineness to which the dried product can be reduced, over 90 per cent. of the starch can be separated in the usual washing and decantation methods, as against a recovery of 65 to 75 per cent. of starch when potatoes are ground in a fresh state.

P. A. Yoder: *Marking of Porcelain and Silica Crucibles, etc.*

Consecutive numbers in platinum or china colors may conveniently and neatly be put upon porcelain or silica crucibles, etc., by use of rubber type.

To apply china colors, a sizing like "Fat Oil," is first stamped upon the crucible, the dry pigment then dusted on, and after the varnish has set, the excess brushed off and the crucible fired in a muffle at a red heat for an hour. Blacks, especially "Lettering Black," gave very satisfactory results and the numbers resisted treatment with hot nitric acid and alkali solutions.

Charles Fox: *Perilla Oil.*

P. E. Brown and R. E. Smith: *Bacterial Activities in Frozen Soils.*

It was found, in the course of an experiment conducted during the winter months of 1910–11, that bacteria which developed on synthetic agar plates, ammonifying, nitrifying, denitrifying and nitrogen-fixing species whose activities were tested by the beaker method, were alive and multiplied in frozen soils.

In explanation of this, the theory is advanced that when soils freeze the hygroscopic water remains uncongealed, because of the surface tension exerted by the soil particles on the film water, its normal concentration in salts, and its increased concentration occurring when the main body of soil water begins to freeze.

Temperature exerted more influence than moisture on the bacteria developing on the agar plates.

H. H. Hanson: *Report of Progress in a Study of the Maine Sardine Industry.*

This paper gives an account of the industry from the taking of the fish to the finished product in the can, mentions problems of economic interest to the packers and others of scientific importance. There are three important respects in which the Maine sardines differ from the foreign sardines, of which the French pack is recognized as the most desirable. First, the fish packed in France under the name sardine is the *Clupea pilchardus*, while the fish packed in Maine under that name is the *Clupea harengus*, two distinct species of the same family. Second, French sardines are packed in olive oil while the Maine sardines are put up in cotton-seed oil. Third, in handling the French pack the single fish is the unit and quality is at all times considered of paramount importance; while in handling the Maine pack the hogshead is the unit and quantity is always sought. The French sardine retails for from thirty-five to sixty cents per can, while the Maine sardine retails for the most part for five cents. The markets for these two grades seem to be well established.

Indications seem to point to the conclusion that swelled cans are caused for the most part by imperfect sealing, although in some cases it would seem as though the sterilizing process was not sufficient.

An important food of the sardines, known to the trade as "red feed" seems to cause rapid deterioration of the fish. This has been identified as a microscopic crustacean of the family Centropagidæ, called *Temora longicornis*. It has been suggested that auto-digestion induced by an enzyme peculiar to this crustacean may be responsible for the rapid deterioration, but it seems more likely from present knowledge of the subject that a methylamine is the cause. Investigation is still going on.

W. B. SMITH: *The Index of Refraction of the Mixed Acids of Fatty Oils.*

Determinations of the ratio between the refraction of oils and of their insoluble acids gave, for linseed, cod liver, soy bean, corn, rapeseed, cottonseed, peanut and olive oils, values between 0.9933 and 0.9942; and for lard, lard stearin, oleo oil, oleo stearin, cocoa butter, butter, palmnut oil, cocoanut oil and a mixture of cottonseed oil and oleo stearin, 0.9923 to 0.9941.

These figures are shown to be in accord with calculations from published refractive indices and with the ratios of the refractions of fatty acids and triglycerides. The ratio is little affected by the saturation of the acid, being about 0.9938 for stearin, olein, linolin and linolenin, but decreases with the lower acids, palmitin, 0.9922; laurin, 0.9905.

Some typographical errors in reference books are noted, and the published refractive index of the acids of olive oil is said to be low by about 0.0050.

B. H. KEPNER: *The Profitable Application of Chemistry to the Milling Industry.*

DIVISION OF PHARMACEUTICAL CHEMISTRY

B. L. Murray, *chairman.*

F. R. Eldred, *secretary.*

B. L. MURRAY (chairman's address): *Our Advances and Retrogressions in Pharmaceutical Chemistry.*

A. B. ADAMS and J. M. DORAN: *Smoking Opium: Its Manufacture and Chemical Composition. Exhibit—Samples and Smoking Outfit.*

LINWOOD A. BROWN: *An Improved Method of Assay for Aromatic Sulphuric Acid.*

The total acidity is determined by direct titration, using phenol phthalein and $N/10$ KOH, after which the "free sulphuric acid" is determined by precipitation as $BaSO_4$.

From the $BaSO_4$ found is calculated the number of c.c. of $N/10$ H_2SO_4 equivalent thereto. This is subtracted from the number of c.c. $N/10$ KOH consumed by total acidity, the difference represents the acidity due to the ethyl sulphuric acid, and from this is calculated the equivalent amount of H_2SO_4.

The U. S. P. method gives too low results, due to the fact that ethyl sulphuric acid is not entirely hydrolyzed on heating for four hours, while in this method the results are higher, closely approaching the theoretical amount of H_2SO_4 known to be present.

Comparative tables of results by the two methods are given.

H. C. HAMILTON: *Notes on Cannabis Indica.*

The paper reviews the more important publications on the chemistry and pharmacology of the drug and describes a process of obtaining a body which possesses high activity.

This substance was not examined chemically, but its physical properties and physiological reactions were investigated and described. It is similar to that of Wood Spivey and Esterfield known as Cannabinol, but is obtained by a different method. No chemical treatment was ca-

pable of separating it into an active and an inactive portion.

Physiologically it was found to produce the typical "Cannabis intoxication" with a smaller dose than any other derivative of the drug so far obtained.

The paper concludes with comments on the peculiarities of this drug, which apparently make it unreliable. This is shown, however, to be due largely to the characteristics of the person on whom the effects are observed and not often, as is commonly supposed, to the variability in the drug itself.

H. C. Hamilton: *The Pharmacopœial Requirements for Cannabis Sativa.*

The U. S. P. requirements are such that commercial samples of this drug can rarely be used as official because the drug has so often passed to the fruiting stage before being gathered, while to specify that it must be grown in India results in excluding a drug of first class quality grown in other localities.

To remedy this it is suggested that the requirements be made partly chemical and partly physiological. *Cannabis Sativa* is botanically identical from whatever locality it comes. Moreover, the extract soluble in cold alcohol is the active part and the yield of this can readily be determined.

Since the yield of an extract of this character is one of the variable factors and its activity the only other factor of importance the proposal is that the standard for *Cannabis Sativa* be that it shall contain not less than 10 per cent. extractive soluble in cold 95 per cent. alcohol. Further, that this extract must react on susceptible dogs when administered internally in a dose of 10 mg. per kilo weight of the dog.

Joseph P. Remington: *Progress on the Work of Revision of the United States Pharmacopœia.*

The American Chemical Society, having representation in the United States Pharmacopœial Convention, should be informed of the progress made from time to time in the work of revision. The sub-committee on scope have made their report and a tentative list of admissions and deletions has been printed in the public magazines and journals. The Pharmacopœia is a book of standards. The necessity for careful and thorough revision. Analytical chemistry the foundation stone in the building of reform structures. The influence of the Food and Drugs Laws on the United States Pharmacopœia. The plan of revision. The American Chemical Society invited by the chairman to send comments, facts and suggestions to aid in the work.

A. D. Thorburn: *The Estimation of Morphine in Cough Syrups.*

A. Zimmerman: *Laboratory Studies of Rennin.*

A study of the properties of this ferment, when prepared by different methods. The variation in the length of time required to curdle different specimens of milk by rennin and how this is influenced by the milk, according to the length of time it is kept after the milking. Standardizing rennin to use as a control in rennin assay, for more accurate results. The acceleration of the action of rennin upon milk by phosphoric acid. The effect of alkalies upon milk, causing a variation of the length of time required to curd milk by rennin. The influence of heat in changing the acidity of milk, kept for a varied number of hours after the milking.

C. M. Pence: *The Bromine and Iodometric Methods for the Volumetric Determination of Cresol.*

Usual bromine methods for determination of cresol depends upon fixed conditions predisposing a previous knowledge on the part of the operator, and while they may be of service they do not satisfy the demand for a desirable method.

Tri brom o. and p. cresol brom compounds can not be formed in a manner analogous to the production of 2–4–6 tri brom phenol brom. Di brom cresol brom compounds are formed and finally tri brom phenol brom; however, o. and p. cresols can not be determined volumetrically by a conversion into these compounds.

Meta cresol is determined by a conversion into tri brom m. cresol.

O. and p. cresols from di iodo compounds and this reaction is made the basis of a method for their determination.

Meta cresol does not yield di iodo compounds under the same conditions; hence, cresol U. S. P. or any mixture containing m. cresol can not be determined by a volumetric iodine method.

L. E. Sayre: *The Analysis of a Very Old Sample of Powdered Gelsemium Root.*

Atherton Seidell: *A Bromine-hydrobromic Acid Method for the Determination of Phenols.*

Charles Baskerville and W. A. Hamor: *The Impurities of Anæsthetic Chloroform and Methods for their Detection.*

The impurities which anæsthetic chloroform brings with it from the manufacturer ("organic impurities") and the oxidation products of chloroform and alcohol are considered chemically

and physiologically, and rigid methods are given for their detection and estimation. "The main impurities contained in American anæsthetic chloroforms are, besides water, impurities decomposable by sulphuric acid and traces of the oxidation products of ethyl alcohol." The comparative purity of various samples of chloroform is discussed, and the necessary precautions which should be taken by manufacturers to guard against contamination are given. It is pointed out that "serious results have occurred from the use of anæsthetic chloroform containing foreign substances, and (that) although the grades at present sold as chloroform for anæsthesia hardly contain impurities which can be held responsible *per se* for deaths which have occurred during narcosis, yet the presence of these may produce some, at least, of the disagreeable after-effects so often noticeable following the administration of some chloroform." Results are given which lend strong support to the view of the authors as to the nature of the oxidation of chloroform and as to the rôle of alcohol in preservation.

M. I. WILBERT: *The Influence of Patents and Trade-marks on the United States Pharmacopœia.*

J. B. WILLIAMS: *The Estimation of Morphine in Pills, Tablets, etc.*

Morphine is more soluble in a mixture of alcohol and chloroform than in either solvent alone.

The aqueous solution of the sample containing morphine is made alkaline and extracted with a mixture of alcohol and chloroform, the alkaloidal solution evaporated to dryness dissolved in volumetric acid and titrated. Estimations can be made in from 2 to 3 hours.

Comparative results with Thorburn's phenylethyl alcohol method are in favor of the alcohol-chloroform method.

FRANK O. TAYLOR: *Note on Mastic and Sandarac.*

C. H. BRIGGS: *The Alcohol Requirement of the Pure Food and Drug Law and the Accuracy of Alcohol Assays of Pharmaceutical Preparations.*

To meet the requirements of the Pure Food and Drug Law, all pharmaceutical preparations must be assayed for alcohol. Alcohol assays are apt to vary for several reasons. Volatile oils and drug extracts tend to give low results.

A ruling to the effect that fluid extracts and elixirs could be labeled with the maximum content of alcohol is very desirable.

FRED. KLEIN: *A Laboratory Study of Vegetable and Mineral Oils.*

FREDERICK J. AUSTIN: *Comments on Tests of the U. S. Pharmacopœia—Eighth Revision.*

Sets forth the discrepancies in the two tests for iron applied to copper sulphate, the apparent necessity of a time-limit in the test for absence of petroleum benzin, kerosene or similar hydrocarbons in oil of turpentine, the necessity of using larger amounts of hydrochloric and nitric acids in determining whether these acids are sufficiently free from arsenic for reagent use, and the unreliability of the U. S. P. test for absence of oxychloride in solution of iron chloride as an indication of whether it is suitable for use in making the U. S. P. tincture of iron chloride.

R. NORRIS SHREVE: *Suggested Modifications to the U. S. P. Assay of Opium.*

Some samples of opium were cited in case of which the U. S. P. assay will not remove but about two thirds of the morphine. So it is suggested that a very vigorous mechanical agitation be given the opium, and that a test be applied to determine the completeness of the extraction of morphine.

It was shown that the U. S. P. alcoholic mother liquors retain up to 100 milligrams of morphine, and to determine this it is suggested that a blank precipitation be made on pure morphine.

To determine the purity of the crude morphine the Mallinckrodt reassay is recommended.

F. P. DUNNINGTON: *Some Unfamiliar Facts about Familiar Detergents.*

J. R. RIPPETOE and R. MINOR: *Colocynth U. S. P.*

W. O. EMERY: *Estimation of Antipyrine in Acetanilid or Acetphenetidin Mixtures.*

W. O. EMERY: *Estimation of Codein in Acetanilid or Acetphenetidin Mixtures.*

L. F. KEBLER and C. H. KIMBERLY: *Standard for Tincture of Ginger.*

An examination of a number of samples of tincture of ginger also at times designated extract of ginger shows that there was a material variation. Tinctures of ginger from the best manufacturers were then purchased and examined. The Pharmacopœia gives a process for manufacturing this article but does not give a specific standard, neither is the variety of ginger to be employed indicated. The latter is interpreted to mean that any kind of ginger may be used. It was therefore decided to purchase representative available samples of the various gingers on the market and use them in the manufacture of tincture of ginger. A description of the samples together with their fineness is outlined in the paper. The preliminary

examination showed that the available samples of Calcutta and Japanese ginger were not of a character suitable for manufacturing the tincture. Tinctures were then made from all of the samples and it was found, as indicated by the analysis, that the Calcutta and Japanese gingers produced tinctures of inferior character. The standard arrived at was as follows: Specific gravity, 0.8200; alcohol, not less than 88 per cent.; non volatile matter, between 1.25 per cent. and 1.75 per cent.

E. O. Eaton: *Estimating Small Quantities of Morphin in Mixtures.*

At the 27th annual convention of the Association of Official Agricultural Chemists, a method for determining small quantities of morphin in mixtures was presented.

The method in brief consists in extracting the morphin from the mixture by means of lime water which is subsequently treated with ammonium chloride, the morphin precipitated, removed with a chloroform-alcohol mixture and the morphin finally determined volumetrically.

During the past year, two mixtures and a sample of opium were submitted to several workers and the results and their observations recorded. In the case of the two mixtures, several workers' results agreed fairly well, but the results obtained with the opium were quite unsatisfactory.

A. G. Murray: *Estimating Small Amounts of Nitroglycerin.*

L. F. Kebler: *Standards and Methods.*

In this paper attention was called to the necessity of carefully studying present available methods and standards. It has been found from time to time that the methods prescribed for arriving at a certain standard are defective and therefore unsuited for careful court work. Particular attention was called to the shortcomings of the present method for determining the alkaloidal content of henbane leaves. The method, as a rule, gives results below the actual content of alkaloidal matter.

The subject of standards was referred to and several specific cases quoted: For example, the standard for cannabis indica is prescribed as a product free from stone cells, which means virtual absence of seeds. Experience shows that it is practically impossible to find such a product on the market. Its enforcement, therefore, would be a most difficult problem. The question of arriving at a fair and just standard was also taken up and discussed fully. For example, the Pharmacopœia prescribes a definite standard for hydrogen peroxid, but it is well known that this commodity is prone to decomposition and the question arose as to what amount of variation should be permitted before considering the article inferior. In order to determine this point, all of the available samples of hydrogen peroxid were purchased and examined by two different observers in several sections of the country. The observations were made during a period extending over one year, and it was found that there was no difficulty whatever in preparing this commodity so as not to fall materially below 15 per cent. of the prescribed standard within six months. If, therefore, a sample of hydrogen peroxid was found to be only one half the strength prescribed by the Pharmacopœia, it was either made by faulty methods or much more time than six months had elapsed since its preparation. Other examples were cited to show that it was absolutely necessary to use judgment and discretion even though the standard was prescribed.

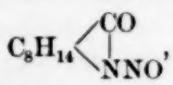
Division of Organic Chemistry

Geo. B. Frankforter, *chairman.*

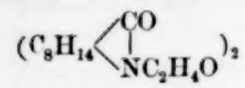
Wm. J. Hale, *secretary.*

William A. Noyes and J. A. Coss: *The Decomposition of Nitroso Compounds.*

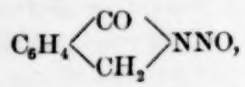
Some years ago Mr. Taveau, with one of us, found that on warming the nitroso derivative of the anhydride of aminolauronic acid,



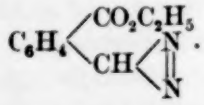
with an alcoholic solution of sodium hydroxide, a compound was formed to which the formula



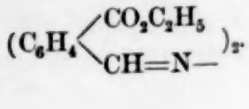
was assigned. A study of the similar decomposition of the nitroso derivative of phthalimidine,



has shown that the primary product is a diazo compound of the structure



This decomposes, giving the compound



In the presence of alcohol it gives the ester ether

$$C_6H_4\begin{cases}CO_2C_2H_5\\CH_2OC_2H_5\end{cases}.$$

The first of these is, of course, the analog of the compound described by Mr. Taveau and the latter is the bishydrazone of camphononic acid,

$$C_8H_{13}\begin{cases}CO_2H\\ \\ N\!=\!N\end{cases}C_8H_{13}CO_2H.$$

HOWARD W. DOUGHTY: *Ortho- and Para-Toluenese-lenonic and Tolueneseleninic Acids.*

NICHOLAS KNIGHT: *The Preparation of Certain Oxylactones.*

When phenyleyan pyroracemic acid ethyl ester is heated with sulphuric acid, the ester is hydrolyzed and water and carbon dioxide pass out of two molecules of the acid. The resulting product is an oxylactone of the formula $C_{17}H_{14}O_3$, which melts at 171°.

When a mixture of phenyl pyro racemic acid is allowed to stand some days with fuming hydrochloric acid the liquid becomes filled with fine needles which on crystallizing from alcohol is shown to be an oxylactone of the formula $C_{16}H_{12}O_3$. The melting point is 206°. A number of salts were made from this oxylactone.

J. U. NEF: *The Three Lactones d-Mannonic Acid and their Bearing on the Constitution of the Sugars and the Glucosides.*

TREAT B. JOHNSON: *The Action of Halogens on Tyrosinehydantoin.*

Methods have been developed for preparing easily 3.5-diiodo-, 3.5-dibromo- and 3.5-dichlorotyrosines. Bromine and iodine react smoothly with tyrosine, $HOC_6H_4CH_2CH(NH_2)COOH$, forming 3.5-dibromo- and 3.5-diiodotyrosines, respectively. 3.5-Dichlorotyrosine is not formed in an analogous manner by the action of chlorine on the amino acid.

Chlorine and iodine react with tyrosinehydantoin, forming the corresponding 3.5-dichloro- and 3.5-diiodotyrosinehydantoins, respectively. Bromine reacts abnormally with tyrosinehydantoin, giving 3.5-dibromobenzalhydantoin.

TREAT B. JOHNSON: *The Action of Potassium Thiocyanate on α-Amino Acids.*

The hydantoin derivatives of α-amino acids are well known, and of great value for the identifications of these acids. The corresponding nitrogen-unsubstituted 2-thiohydantoins, however, are not known. A practical method has now been developed by which representatives of this new class of compounds can be easily synthesized. The 2-thiohydantoin derivatives of glycocoll and alanine have already been prepared.

The present communication is in the nature of a preliminary statement regarding the extension of this work to other α-amino acids, which has already been begun. The results indicate that this class of compounds will be of great value in helping us to develop other syntheses of biological significance.

CLARENCE G. DERICK: *Correlation of Ionization and Structure in the Aromatic Series.*

CLARENCE G. DERICK: *A New Proof of the Equivalency of the Pair of Positions 3 and 5, with Respect to Position 1, in the Benzene Ring.*

HARRY S. FRY: *A Critical Survey of some Recent Applications of the Electron Conception of Valence.*

ALVIN S. WHEELER: *New Thermometers for Accurate Melting-point Determinations.*

The thermometers are of the usual length but are graduated only at the lower end so that the graduations are completely immersed in the liquid of the ordinary melting-point bath, the Thiele for instance. There are seven in the set in order to cover the necessary range. They may be obtained of C. Richter, of Berlin, and standardized by the Reichsanstalt. They have met the approval of some very well known men.

ALVIN S. WHEELER: *The Walden Inversion.*

A model consisting of celluloid balls of various colors attached to corks covered with wire bristles designed to attach same to a large bristle-covered ball, the C atom, was exhibited to illustrate the theory propounded by Emil Fischer to explain the Walden inversion. The case studied by the author with Fischer was that of α-hydroxyisohexoic acid. This acid was split into its active forms, the lævo being obtained in pure condition. Its ethyl ester with PBr_3 yielded a bromo ester which was strongly dextrorotatory. But the lævo acid with NOBr gives a lævo bromo acid which yields a lævo bromo ester.

R. R. RENSHAW: *Studies in the Methods of Preparation of Diglycerides.*

The reaction between salts of stearic acid and 1, 2-dibrom and diiodhydrin have been investigated between the temperatures of 130° and 200°. There is formed stearic acid, distearin tristearin and small amounts of a compound containing bromine and stearic acid. Good yields were never obtained. The use of the lead salt seems to be preferable.

At slightly above its melting point dibromhydrin dissociates completely into two molecules, hydrobromic acid and probably epibromhydrin.

Pure 1, 2-dilaurin, diisovalerin and diacetin have been obtained.

R. R. Renshaw: *Investigation of Choline and its Derivatives.* (Third paper.)

By the action of phosphorus oxychloride on choline chloride there has been obtained a highly hydroscopic, unstable chlorcholine phosphoric acid dichloride.

Experiments on the stability of choline salts have been carried out both by physiological and chemical tests. Pure choline salts give a lowering of the blood pressure. Choline chloride is not a very unstable salt. It can be preserved without decomposition into trimethyl amine or neurine.

William J. Hale: *The Formation of Nitropyrimidines.*

Chas. H. Herty and C. S. Venable: *The Schkateloff Method for Reduction and Precipitation of Resin Acids.*

Carl O. Johns: *On 2-Oxy-1-Methylpurine.*

The potassium salt of 2-oxy-5-nitro-6-aminopyrimidine was heated with methyl iodide and a monomethyl derivative was obtained. The position of the methyl group was ascertained by converting this compound into 2, 6-dioxy-3-methyl-5-nitropyrimidine. When 2-oxy-3-methyl-5-nitro-6-aminopyrimidine was reduced with ferrous hydroxide it gave 2-oxy-3-methyl-5, 6-diaminopyrimidine, which in turn gave a formyl derivative the potassium salt of which, when heated, formed the potassium salt of 1-methyl-2-oxypurine. The free base crystallized with 2 molecules of water. The picrate decomposed at 214° C.

Carl O. Johns: *On 2-Oxypurine and 2-Oxy-8-Methylpurine.*

2-Oxy-5, 6-diaminopyrimidine was heated with formic acid and a monoformyl derivative was produced. The potassium salt of this compound liberated water when heated and the potassium salt of 2-oxypurine was produced. The free base crystallized with one molecule of water and the crystals were stable at 110° C., but the water escaped at 130° C. The picrate decomposed at 245° C.

Acetic anhydride reacted with 2-oxy-5, 6-diaminopyrimidine and the chief product was a monoacetyl derivative. The potassium salt of this was heated and the potassium salt of 2-oxy-8-methylpurine was obtained. The nitrate decomposed violently at 205° C. and the picrate at 250° C.

M. L. Crossley: *A New Derivative of Anthroquinone.*

M. T. Bogert and M. Heidelberger: *Phthalones in the 4-Quinazolone Group.*

2-Methyl-4-quinazolone condenses smoothly with phthalic anhydride to the symmetrical phthalone, which behaves as a weak acid, forming a yellow mono-sodium salt and a red disodium salt, as well as a red mon-anil, a mono-phenylhydrazone and a sulfonic acid. Energetic reduction converts the phthalone into the corresponding hydrindone. Bromination of the sulfonic acid of the phthalone in aqueous solution yields a dibrom 2-methyl-4-quinazolone, which is not the 6, 8-dibrom compound, a pentabrom 2-methyl-4-quinazolone, a monobrom 2-methyl-4-quinazolone sulfonic acid, phthalic and sulfuric acids. An interesting feature of the reaction is that the bromine splits the phthalic acid off from the quinazolone.

6-Nitro and 7-acetamino 2-methyl-4-quinazolone condense similarly to phthalones. With phthalimide, the 2-methyl-4-quinazolone condenses to the unsymmetrical, or beta, phthaline, with formation of a small amount of what appears to be a bis-quinazolone phthaline.

2-Methyl-4-quinazolone and succinic anhydride react vigorously with production of a tarry mass, from which a colorless anhydro body may be isolated.

2-Methyl-4-quinazolones carrying alkyl groups in position 3 either refuse to condense with phthalic anhydride or give but small yields of phthalone.

In none of the experiments was the formation of any isophthalone observed, nor could we isolate any intermediate products except the phthalate of the quinazolone.

Like the quinophthalones, these phthalones act as yellow dyestuffs, but in tinctorial power they seem inferior to the former.

M. T. Bogert and G. A. Geiger: *On Certain New Quinazolines.*

The following new 4-quinazolones have been isolated and studied: 3-ethyl; 3-benzyl; 2-methyl-3-p-nitrophenyl; 2-methyl-3-p-tolyl; 2-methyl-3-alpha naphthyl; 2-methyl-3-beta naphthyl; 6-nitro; 6-amino; 6-acetamino; 6-nitro-3-methyl; 6-amino-3-methyl; 6-acetamino-3-methyl; 6-nitro-3-ethyl; 6-amino-2, 3-dimethyl; 6-nitro-2-methyl-3-ethyl; 6-amino-2-methyl-3-ethyl; monobrom and brom-2-methyl.

The 3-methyl-4-quinazolone of Knape (m.p. 71°) carries a molecule of water of crystallization, the pure anhydrous substance melting at 105°.

Nitration of 2-methyl-3-phenyl-4-quinazolone with a mixture of concentrated sulfuric and fuming nitric acids gives a dinitro derivative; by similar treatment of 2-methyl-3-p-nitrophenyl-4-quinazolone, only one nitro group is introduced; but these two dinitro derivatives are not identical. Nitration of 2-methyl-3-p-tolyl-4-quinazolone also gives a dinitro derivative. The action of nitric acid, in presence of metallic mercury, upon 2-methyl-4-quinazolone gives only the mercury salt of the latter, whereas with quinoline a nitro-hydroxy derivative is produced.

The 4-quinazolones are not readily brominated, but by the Juvalta process bromine derivatives may be obtained.

M. T. BOGERT and G. A. GEIGER: *On Quinazolone Iodomethylates.*

Iodomethylates, and other iodoalkylates, have been prepared from a large number of quinazolines, and the following general conclusions are drawn from the experiments:

1. 4-Quinazolones add alkyl iodides generally only under pressure at about 110°.

2. The alkyl iodide adds to the N adjacent to the benzene nucleus (*i. e.*, the N in position 1 in the quinazoline nucleus) and not to the N in position 3, since the compounds obtained by adding methyl iodide to 2-methyl-3-ethyl-4-quinazolone and ethyl iodide to 2, 3-dimethyl-4-quinazolone are not identical.

3. The iodoethylates are more soluble in water, and in methyl alcohol, than the iodomethylates.

4. By the action of methyl iodide alone, in excess, 4-quinazolone, 3-methyl-4-quinazolone and 4-methoxyquinazoline, all give one and the same product, namely, the iodomethylate of 3-methyl-4-quinazolone.

5. Many of the nitro 4-quinazolones refuse to combine with methyl iodide.

6. Styryl 4-quinazolones add methyl iodide more readily than ethyl iodide, but certain groups in position 3 appear to prevent the combination even with methyl iodide.

7. By the action of silver nitrate upon some of these iodomethylates, corresponding methyl nitrate addition products have been obtained.

M. T. BOGERT and L. E. WISE: *On p-Aminobenzonitrile.* (Third paper.)

The following additional compounds have been prepared and studied: p-aminobenzonitrile picrate, p-cyanoxanilamide, oxanilic p-cyananilide, p-cyansuccinanilic acid, its silver salt, methyl and ethyl esters, and anil, p-cyanphthalanilic acid and its anil, p-cyanphenylurethane, p-caramido phenylurethane, p-cyanphenyl urea, carbanilic p-cyananilide, p-cyancarbanilide, methylene di(p-cyanphenamine), 3-nitro-4-acetamino benzamide and 3, 4-diacetyldiaminobenzonitrile.

The nitrile appears to add a molecule of chloral directly, and then on dehydration gives the trichlorethylidene di-p-cyanphenamine.

Bromination of the acetamino nitrile, like nitration, gives the mono substitution product.

From 3, 4-diaminobenzonitrile, the 3-cyan-alpha-methyl benzimidazole can be obtained as well as the corresponding amide.

M. T. BOGERT and G. D. BEAL: *A Further Study of the Stilbazoles, Hydrazones and Schiff Bases in the 4-Quinazolone Group.*

In the condensation of aldehydes with alpha-methyl pyridines or quinolines, the alkines evidently form easily and are often so stable that considerable difficulty is experienced in dehydrating them to the stilbazoles. With these quinazolone condensations, on the other hand, the alkines either do not form at all or are so unstable that they immediately lose water and give the stilbazole. Neither hydrogen nor bromine can be added to the double bond of these stilbazoles, but bromine gives rise to substitution products.

A large number of new aldehyde condensation products were prepared of the above types. Most of the styryl quinazolones are pale yellow and crystallize in fluffy masses of short silky needles. Often they show strong tribo-electric properties. Those with a free hydrogen atom in position 3 usually dissolve readily in solutions of the caustic alkalies and are reprecipitated by carbon dioxide.

Incidentally, a number of new quinazolines were prepared by condensing various amino bodies with acylanthranils, and certain of them were tested with reference to their physiological effect upon animals.

Under the conditions of our experiments, the group which reacted most readily with aldehydes was the 3-amino group, then the 2-methyl, then the 7-amino, while the 2-amino refused to condense at all. Benzaldehyde proved much the easiest aldehyde to condense with these groups, often reacting when all other aldehydes tried failed.

M. T. BOGERT, R. A. GORTNER and A. H. KROPFF: *On Certain New Dyestuffs.*

By condensation of acylanthranils with aromatic primary diamines, new amine bases result which can be used for the production of dyestuffs

in much the same manner as the anilines or naphthylamines.

This paper describes only certain of the azo dyes obtained from these new quinazoline bases, together with a few other related dyestuffs. The dyes described are (*A*) those obtained by diazotizing aminoquinazolines, with the amino group either on the benzene or on the miazine portion of the nucleus, and coupling with various well-known couplers; and (*B*) those obtained by using these new bases themselves as couplers for the ordinary diazo salts.

Monazo and polyazo dyestuffs can thus be produced in infinite variety. Those obtained from acylamino acylanthranils may be de-acylated and the liberated amino group again diazotized and coupled.

These new dyes include direct dyestuffs for cotton, as well as for wool and silk. Many are fast to light, acid or alkali, washing and milling, bleaching, etc.; they penetrate the fiber well and give level dyeings.

Wm. McPherson and Cecil Boord: *The Preparation of Orthoquinones with Complex Side Chains and Their Reactions with Hydrazines.*

E. K. Marshall, Jr., H. C. Robertson, Jr., and Miss J. Peachy Harrison: *On the Mechanism of the Reactions of Ethylates with Alkyl Halides.*

N. E. Loomis, C. N. Myres and S. F. Acree: *The Use of the Hydrogen Electrode in Organic Chemistry.*

Ralph H. McKee: *The Preparation of Sulfonic Acids.*

The process of sulfonating aromatic hydrocarbons can be greatly facilitated by the use of vigorous stirring, *e. g.*, cymene with slightly more than its own volume of sulfuric acid (sp. g. 1.42) gave at room temperature in twenty minutes complete sulfonation, where by the use of infusorial earth it requires several days, or shaken by hand on the water bath with much excess of acid it requires a number of hours. The stirrer used rotated 900 times a minute.

Paraffin hydrocarbons, the portion boiling about 200° from ordinary kerosene, stirred with ordinary sulfuric acid at room temperature was partially attacked to give a disulfonic acid. With the fuming acid the hydrocarbon was all attacked with formation of a mixture of sulfonic acids and oxidation products. Strong nitric acid by similar treatment also attacks the paraffin hydrocarbons at ordinary temperature, but the products formed have not as yet been analyzed.

The distinction between the hydrocarbons of the benzene and methane series toward sulfuric and nitric acids shows evidence of being due in large part to the less solubility of the paraffin hydrocarbons in acids rather than to an essentially different chemical character, *i. e.*, the difference is in part one of physical properties (solubility) rather than one of chemical properties.

I. K. Phelps: *The Preparation of Cyanacetic Acid in Quantity.*

Biological Chemistry Section

Carl L. Alsberg, *chairman.*

I. K. Phelps, *secretary.*

W. M. Clark: *Gases of Swiss Cheese.* II.

Since the gas formed in Emmental cheese is the immediate cause of the formation of the characteristic "eyes," it was hoped that data concerning the gases produced would aid in diagnosing the bacteria which are thought to be responsible for the development of the eyes.

For this purpose apparatus was devised for collecting the gases found in the "eyes" and in "pin holes" and the body of the cheese. It was found that the gas of normal eyes consists largely of CO_2 and nitrogen. Hydrogen is sometimes present in very small percentages. The abnormal production of gas which takes place frequently the first day was found to be accompanied with large percentages of hydrogen.

The gas produced by normally developing cheese during the period of its maximum eye-formation was found to be chiefly CO_2.

The absorption of oxygen was studied as well as the permeability of cheese to different gases.

In the light of all the facts thus gained a discussion is made of the interchange of gases and of the relation of these to theories concerning the formation of the eyes.

L. W. Fetzer: *The Cholesterol Content of Milk under Normal and Pathological Conditions.*

From this work it can be noted that a decrease in the cholesterol content of milk takes place under pathological conditions, and where a decrease in cholesterol content was noted there was a corresponding decrease in the fat content. If, however, the cholesterol content was compared with the milk fat on the basis of 100 parts of ether extract, then the cholesterol seemed to be increased.

J. P. Atkinson: *Quantitative Results of Certain Poisonous Metals and Alkaloids after Digestion of their Enveloping Tissue in Artificial Gastric Juice.*

E. D. CLARK and F. J. SEAVER: *Studies on Soils Subjected to Dry Heat.*

In the present paper we have extended to the green plants our earlier observations of the effects of heated soils upon the growth of fungi. Different degrees of dry heat give soils whose aqueous extracts have a brown color the depth of which is proportional to the intensity of the heat. The amount of soluble matter, organic, inorganic, nitrogen, etc., was also proportional to the different temperatures (90° to 180° C.). The dark extracts from strongly heated soils were favorable for fungous growth but were distinctly unfavorable to Lupin seedlings grown in them; this inhibiting action being greatest in the darkest colored extracts. Oats sown in a series of soils heated to different temperatures showed a slight stimulation for the temperature up to 125°, when compared with the unheated soil as a control; while above 125° the heated soil had a very toxic effect. The organic matter of the darker extracts gives nearly all the tests for reducing sugars, is largely precipitated by acetone, smells like caramelized sugar, and has a strong acid reaction to litmus.

R. H. JESSE and EDWARD BARTOW: *Composition of Gases Formed by the Decomposition of Organic Matter.*

We were called upon to investigate the cause of an explosion of gases in a septic tank at Highland Park, Illinois. In trying to trace the cause of this explosion we collected and analyzed gases from several septic tanks. But little variation was found between the composition of the gases from the tank which exploded at Highland Park and the gases from other tanks in the central west. There was, however, a great variation between the composition of these gases and the reported composition of gases analyzed by other investigators. During the summer of 1911 samples of gases were collected and analyzed from tanks in Illinois, Columbus, Ohio, from Worcester, Massachusetts, and from the Illinois River below the mouth of the Drainage Canal. The greatest difference is seen in comparing the gases from Worcester with the gases from Illinois tanks. The gases from the Illinois River agree closely in composition with the gases from some of the septic tanks and differ very materially from a sample of gases collected from an unpolluted swamp. We have noted differences in gases taken from different compartments of the same tank and there is an apparent difference in gases collected below the upper sludge and in the bottom.

We feel that the results thus far obtained can only be regarded as preliminary to further study of the subject.

E. D. CLARK and R. A. GORTNER: *The Chromogen and Associated Oxidases in the Mushroom Strobilomyces strobilaceus.*

L. A. HAWKINS: *The Effect of Certain Chlorides Singly and Combined in Pairs on the Activity of Malt Diastase.*

R. A. GORTNER and E. D. CLARK: *The Chromogen and Associated Oxidase in the Mushroom, Strobilomyces strobiloaceus.*

Upon injury the color change of this fungus is from white through pink to black, this action being a rapid one. We considered that this was a case of ordinary tyrosinase activity and it was only upon examining the material for another purpose that we learned that this assumption was not true. We were unable to detect the slightest trace of free tyrosin by any of the delicate color tests. However, we were able to make preparations of an oxidase from this plant that were very active in causing the oxidation of a tyrosin solution. Evidently, then, this fungus contains a tyrosinase or similar enzyme which oxidizes some other chromogen. This chromogen proved to be pyrocatechin or one of its derivatives, as shown by all the tests and methods at our disposal. The oxidase preparation produced exactly the same change in a solution of pure pyrocatechin that is noticed in the plant itself.

H. H. BUNZEL: *Biochemical Study of the Curly-top Disease of Sugar Beets.*

The paper gives results obtained in oxidase measurements on diseased and healthy beets, on leaves as well as roots, under the various conditions at different times of the day and various stages of development. The result obtained in greenhouse experiments, *i. e.*, that the diseased leaves have a higher oxidase content than the healthy ones, was confirmed in the field. The general result of all the experiments carried out, indicates that the oxidase content is higher in the leaves in all the cases where the normal growth of the plant has been interfered with, whether the retardation of growth is brought about by excessive drought, excessive watering of the soil, the curly-top disease or other diseases. The distribution of the oxidase in the leaves and roots of the plant was measured. Analyses of the samples collected simultaneously with the oxidase determinations are as yet not completed.

C. L. Alsberg and O. F. Black: *Phytochemical Studies in Cyanogenesis.*

The relation between the nitrates in the soil, nitrification during drought and cyanogenesis in sorghum, based on experiments done at the Arlington Farm in the course of the past summer, is discussed and an incidental error in the common method of determining hydrocyanic acid in plants is pointed out.

C. L. Alsberg and W. M. Clark: *Notes on the Blood of Limulus polyphemus.*

P. A. Yoder: *The Presence and Identification of Choline in Wheat and Cotton Seed Flours.*

Oswald Schreiner and J. J. Skinner: *The Action of Nucleic Acid and its Decomposition Product on Soils and Plants.*

Nucleic acid as well as some of its decomposition products occur in soils and the effect of some of these compounds has been studied with wheat seedlings. Mineral nutrient solutions with phosphate, potash and nitrate in varying proportions were used, and to these were added 50 parts per million of the compound tested. The neutralized nucleic acid as well as its nitrogenous decomposition products, hypoxanthine and xanthine, had a beneficial action on the plants, promoting growth and decreasing the nitrate absorption. The plants appear to be able to utilize these compounds directly in their metabolism and require under these circumstances less nitrate for maximum growth.

M. X. Sullivan: *Origin of Creatinine in Soils.*

Of samples of the same soil planted and unplanted kept side by side in the greenhouse, the water and glycerine extracts of the planted soils gave larger amounts of creatinine by the creatinine zinc chloride method. It would seem that the increase in the amount of creatinine was connected in some way with plant growth. Creatinine was found in small amounts in the water in which wheat seedlings had grown, in wheat seeds, wheat seedlings, wheat bran, rye, clover, alfalfa, cowpeas and potatoes. Besides the possible production of creatinine by microorganisms and the introduction into soil in the animal excreta of stable manure, the creatinine of soils has its origin in vegetable matter.

Edmund C. Shorey: *Nucleic Acids in Soils.*

Nucleic Acids have been obtained from soils by extraction with dilute sodium hydroxide, neutralizing and concentrating under reduced pressure, acidifying with acetic acid and addition of several volumes of alcohol as a light-colored amorphous body which on hydrolysis gave pentose sugars, purine bases, pyrimidine compounds, levulinic acid and phosphoric acid. Xanthine and hypoxanthine were identified among the purine bases and cytosine among the pyrimidine compounds.

Aubrey V. Fuller: *The Biological Oxidation of Sodium Arsenite in Solution.*

The author has shown that sodium arsenite in solution may undergo practically complete oxidation to arsenate through the agency of a microorganism or—organisms as yet not identified. The organisms differ from the nitrifying bacteria of Winogradsky in that this activity is evidenced only in the presence of ordinary culture media, such as meat infusion.

G. A. Russell: *The Effect of Mold on the Chemical Composition of the Fixed Oil from Brazil Nuts.*

C. F. Langworthy and R. D. Milner: *An Improved Form of Respiration Calorimeter and its Use for the Study of Problems of Vegetable Physiology.*

W. E. Tottingham: *The Influence of Bacteria on the Soluble Phosphorus of Manures.*

Relevant to a project embracing study of reactions between farm manure and reenforcing substances, such as feldspar, rock-phosphate and peat, investigation of fermenting manures has shown in all cases decrease of water-soluble phosphorus. Fermenting mixtures of manure and rock-phosphate have shown greater decreases than manure alone. A typical experiment with mixed cow and horse manure fermented six months without and with rock-phosphate (25 lbs. fresh manure and ½ lb. rock-phosphate) involved 16.45 grams soluble phosphorus in the manure and 18.49 grams in the phosphate mixture at the start. The water-soluble phosphorus of the manure decreased from 86.7 per cent. to 65.6 per cent. of the total, a decrease of 24.3 per cent. of the original water-soluble phosphorus. The sample with phosphate gave a decrease from 34.3 per cent. to 14.7 per cent. of the total phosphorus, a loss of 57 per cent. of the water-soluble phosphorus. Common solvents for inorganic phosphates, such as carbonated water, ammonium citrate solution and *N*/5 nitric acid recovered the depressed phosphorus only partially.

Two and one half months standing with and without antiseptics produced the following changes of water-soluble phosphorus in manure-rock-phosphate mixture. Normal fermentation; decrease from 33.26 to 17.64 per cent. of total. Saturated with chloroform; decrease from 32.61 to 28.11 per

cent. Saturated with formaldehyde; decrease from 29.36 to 26.85 per cent. The losses amounted to 47.0, 13.8 and 8.5 per cent., respectively, of the water-soluble phosphorus. The results seemed to indicate that the losses observed were not due primarily to "reversion" of inorganic phosphates, but chiefly to bacterial activity.

Manure bacteria grown on media prepared from extract of fresh manure-rock-phosphate mixture reduced the soluble phosphorus of the media 23.8 to 63.6 per cent. Fresh intact bacterial cells of specific organisms and manure flora contained 34 to 53 per cent. of their phosphorus in water-soluble form. Drying in vacuo at room temperatures did not alter the solubility of the phosphorus appreciably. The residual phosphorus was partly recovered from crushed cells by water and did not appear especially resistant to 0.2 per cent. acid or alkali solvents. These results appear to point conclusively to bacteria as the chief cause of loss of soluble phosphorus in fermenting manures.

Further work is in progress with acid-phosphate and involving also the rôles of soil organisms and the plant in rendering phosphorus of manure bacteria available to crops.

JOHN H. LONG: *A Series of Complete Urine Analyses.*

This paper is a study of the urine of a number of men in normal health and on a protein diet amounting to from 70 to 88 grams daily. The results, presented in tabular form, embraced determinations of the bases calcium, magnesium, sodium, potassium and ammonium and the important acids present.

For each urine the various acid and basic ions present were reduced to the hydrogen equivalent and these results shown in tables. While there was an apparent excess of acid in each case it was shown that with proper consideration of the probable urate and phosphate combinations some of the urine should exhibit an alkaline reaction toward litmus, as was, in fact, the case.

The results are from the mixed aliquots saved from urines collected through a period of about 35 days, and embraced a study of the nitrogen and other factors as well as the acids and bases.

JOHN H. LONG: *Some Further Studies on the Composition of Feces Fat.*

Some years ago attention was called by the writer to the rather large amounts of organic phosphorus compounds found in the fat of feces studied in his laboratory. This is a continuation of these examinations, and analyses were made of the fats from the feces of six men collected through long periods. These analyses embraced not only a determination of the phosphorus, but numerous other factors as well. The means of the results obtained show that the phosphatide content of the fat is larger than usually stated in works on physiological chemistry.

OSWALD SCHREINER and J. J. SKINNER: *The Effect of Guanidine on Plants under Different Conditions.*

Guanidine is harmful to plants. The effect of 50 parts per million was tested on wheat seedlings in solution cultures and in soils. The solution cultures consisted of nutrient solutions of varying composition in phosphate, nitrate and potash. The toxicity of the guanidine does not show until the fifth or sixth day, when spots appear on the leaves and soon the plant is completely affected and by the end of the second week the tops fall over. The effect of nitrates in the cultures is especially striking in that the harmful effect first shows itself in the cultures highest in nitrate and spreads gradually to those lower in nitrates and frequently does not appear at all in those cultures which contain phosphate and potash but no nitrate. In other words, we have here the interesting case of a harmful nitrogenous constituent, the harmful effect of which is accentuated by nitrates. Nitrogenous compounds other than nitrates, such as asparagine, creatinine or stable manure, when used in conjunction with guanidine, did not produce the harmful effect noticed with sodium nitrate.

WILLIAM SALANT and J. B. RIEGER: *Further Studies on the Demethylation of Caffein.*

Studies carried out on rabbits, guinea-pigs, dogs and cats show that demethylation in the carnivora takes place far more readily than in the herbivora, the amounts of caffein eliminated unchanged by the former being very small. The process of demethylation therefore varies quantitatively as well as qualitatively in the above animals.

C. B. BENNETT: *Note on the Distribution of Inosinic Acid.*

Inosinic acid was isolated and identified from the fresh muscular tissue of pigeons.

L. E. WARREN: *A Note on the Poisonous Properties of Parthenocissus quinquefolia.*

The death of a child after eating the berries of the Virginia creeper was recently noted by the public press. While the recorded instances of poisoning from this plant are very few, an examination of the literature showed that oxalic acid has been found in nearly all parts of the plant.

Its quantity does not appear to have been determined, but, pending further investigation, the plant should be regarded with suspicion.

I. G. McBeth and R. C. Wright: *Certain Factors Limiting Nitrification.*

Two per cent. of glucose and two per cent. of starch disappeared from soil in less than seven days. Cellulose disappeared more slowly. The addition of glucose and starch caused a rapid disappearance of nitrate from eastern and western soils; with cellulose the reduction of nitrate was less rapid.

Two per cent. of fresh horse manure caused only a partial disappearance of soil nitrate. After seven days in eastern soil and twenty-one days in western soil nitrification became active, causing an increase in nitrate.

Nitrification took place rapidly in rotted manure; the addition of five per cent. of cellulose caused rapid denitrification.

Nitrification in the soil is inhibited by carbonates, chlorides and sulphates, the former having the strongest effect and the latter the least effect.

There are certain seasonal variations in the rate of nitrification in soil.

J. B. Rieger: *Identification and Precise Estimation of Minute Amounts of Caffein in Physiological Products.*

M. O. Stafford: *Preliminary Study of Iron Peptonates.*

V. K. Chesnut: *Estimation of Small Quantities of Pepsin.*

M. Louise Foster: *A Study of the Decomposition Products of Milk Caused by B. lactis erythrogenes.*

Sterile milk inoculated at room temperature with *B. lactis erythrogenes* gave after a few days a faintly red solution, which on longer standing became blood red with coagulation of the milk. During standing—from two to six months—the red liquid became viscous, then fluid again with the formation of a white granular precipitate. The liquid was alkaline and gave the biochemical tests which showed that the organism had attacked the protein molecule as well as the carbohydrate. From 5 to 8.6 per cent. of the total native protein remained unattacked while the remainder was identified as proteoses and monamino acids. The pigment was extracted with amyl alcohol and precipitated with acetone in clusters of red crystals. Further, colorless crystals with alkaloidal odor were obtained. An enzyme was isolated in the usual way. It was found to coagulate milk, giving a supernatant liquid acid to litmus. This acidity was found to be due to the presence of acetic and formic acids. No lactic acid was found.

Oliver E. Closson: *Local Anesthetics: Some Comparative Physiological Reactions.*

W. H. Schultz and Atherton Seidell: *The Elimination of Thymol.* I. *Feces.*

A. B. Macallum: *The Rôle of Surface Tension in the Distribution of Salts in Living Matter.* (Illustrated with lantern slides.)

J. F. Breazeale and J. A. LeClerc: *The Influence of Reaction of Culture Medium on the Development of Roots of Wheat Seedlings.* (Illustrated.)

G. A. Menge: *Some New Compounds of the Choline Type.*

Charles B. Bennett: *Note on the Distribution of Inosinic Acid.*

Oscar Riddle: *On the Chemistry of the White and Yellow Yolk of Ova.*

D. W. Wilson and P. B. Hawk: *On the Relation between Water Ingestion and the Ammonia, Phosphate, Chloride and Acid Concentration of the Urine.*

Lawrence T. Fairhall and P. B. Hawk: *The Fecal Amylase Output during Fasting and Water Drinking.*

D. W. Wilson, P. E. Howe and P. B. Hawk: *The Distribution of Urinary Nitrogen as Influenced by the Ingestion of Moderate and Copious Quantities of Distilled Water at Meal Time.*

Charles O. Appleman: *Metabolism in Dormancy of Tubers.*

A. D. Emmett and Carl Christopher: *Effect of the Quantity of Protein Ingested on the Nutrition of Animals.* V. *On the Chemical Composition of the Skeleton of Swine.*

The skeleton of pigs, selected from three lots—fed on low, medium and high protein planes—showed: (*a*) that the percentage of fat varied with the protein fed; (*b*) that the per cent. of protein was lowest in the low-fed lot and the same in the other two; (*c*) that the per cent. of ash and phosphorus seemed to be independent of the feed. With the tibia, femur and humerus bones, their weight, length, diameter, breaking strength and modulus of rupture seemed to suggest that the medium-fed pigs had the most compact and firm bones. The weight of the skeleton was greatest percentagely in the low-fed lot.

A. D. Emmett and H. S. Grindley: *The Relative Nutritive Value of the Cuts of Beef.*

Comparing the protein and fat content of the

edible meat of the eleven wholesale cuts of beef obtained from three steers—the flank, plate, rib, rump and loin were highest in fat, and the clod, round and shanks in protein. Fat made up from 68 to 92 per cent. of the total calorific value. The energy varied directly as the percentage of fat, ranging from 235.1 calories in the clod to 554.9 in the flank. Comparing the grams of meat required to supply 100 calories from the fat and protein, it takes about half as much of the fatter cuts. The most economic cuts from this standpoint are the chuck, plate, clod and shanks.

E. W. MORSE and L. W. FETZER: *The Present Knowledge in Regard to the Nature of Peach Yellows Disease.*

Summing up our present knowledge in regard to the disease of peach trees known as yellows, it seems natural to conclude that this is a constitutional disease which is inheritable; that is, the progeny have inherited a hypersusceptibility to the disease. The symptoms of the disease—premature ripening of the peach and the appearance of superficial red spots and streaks throughout the flesh of the same, and a yellowing of the leaves the following spring, etc.—seem to point to the hypothesis that the disease is a metabolic one, due to a disturbance of the equilibrium among the enzymes of the plant. Probably there is a hyper-production of the oxidases and a lesser production of the other enzymes, which are active during the life cycle of the plant.

A. R. ROSE: *The Influence of Phytin on Seedlings.*

Phytin has been found universally present in seeds and by some investigators considered to play a significant rôle in germination and early growth of plants and the growths of animals. Nagaoka, Aso and Yoshida in the Imperial Agriculture College in Tokyo have shown that the phosphorus of plants are less beneficial to plant growth than that from animal scraps and wastes, also that the soluble organic phosphorus gave poorer ultimate results as fertilizer material than lecithans and the various inorganic forms of ortho-phosphates except $AlPO_4$ and $FePO_4$. In view of this, experiments were planned and executed to determine, if possible, what the influence of these phosphorus compounds may be upon the earliest growth of the plants. Lupin seedlings were germinated and afterwards allowed to grow in nutrient solutions, some of which contained a phytin compound, for periods of two or more weeks and the influence on the primary root noted. The results seemed to indicate that the several phytates behaved in the same manner as the corresponding ortho-phosphates. There was no suggestion of any specific influence of the phytic anion upon the seedlings. The phytin solutions in which the seedlings had grown showed no increase in inorganic phosphorus nor inosite and there was therefore no evidence that the phytase of the seed acted upon the phytin in the surrounding liquid. The author contemplates further experiments along this line.

A. R. ROSE and J. T. CUSICK: *The Influence of Phosphorus Compounds on the Yield and Composition of Goat's Milk.*

A preliminary report of a metabolism experiment, the fifth of a series planned by Director Jordan. The former experiments conducted with cows gave interesting results with respect to the milk flow and composition. There was a consistent increase of fat and decrease of milk volume with the increase of phosphorus over a very low phosphorus ration, and *vice versa*. The other constituents of the milk were not appreciably affected. A recent paper by Fingerling gives results contrary to these conclusions, but he used goats and his rations were of different constituents in the high and low phosphorus periods. The data from this experiment tend to confirm the conclusions of the previous experiments at this station and are not at all in harmony with Fingerling's observations, but the results are not as consistent as were those when cows were used. There is a regular parallelism between the milk flow and the various constituents of the milk, except with respect to the fat. In two of the four periods the fat increased and the milk flow decreased with the increase of phosphorus in the rations; in the other two periods the reverse was true. Further investigations are now in progress at this station.

A. R. ROSE: *The Toxicity of Phytin.*

A series of experiments conducted on rabbits weighing approximately 2 kilograms gave in two cases unexpected results. Feeding five grams of the sodium salt of phytin was followed in one and one half hours by death. Analysis of the stomach and intestinal content yielded almost half of the soluble organic phosphorus administered. Death was therefore apparently due to 3.2 grams and 3.66 grams sodium phytate, or 1.7 grams per kilogram.

Methods used and an improved cage described.

H. M. ADLER: *Vicarious Fat Deposits in Rabbits Chronically Poisoned with Oil.*

A. A. EPSTEIN and S. BOOKMAN: *Studies in Glycocoll Formation in the Body.*

Albert A. Epstein: *Contribution to the Study of Blood Serum and Serous Effusions.*

The composition of blood sera varies in disease. The changes which occur require careful analysis in close relation with the pathology of the disease investigated. The relation of disease to the production of changes in the chemical composition of the blood, and, also, the relation of alterations in the blood to the production of disease are subjects requiring special study. The effusions present distinct chemical differences, depending upon the site of their production, the nature of the underlying disease and the chemical composition of the blood.

Albert A. Epstein: *Immuno-chemical Studies on Peptones.*

The different peptone fractions seem to be able to alter the different blood elements sufficiently to affect their immunological reactions. This power is not possessed by all the peptones equally, either qualitatively or quantitatively. If we regard the phenomenon of hemolysis by immune serum in the light of a biochemical process, depending upon properties possessed by certain constituents of the serum and the red blood cells, the albumoses and peptones show differences in their behavior toward the elements concerned in the production of hemolysis.

Theo. Kuttner: *Some Findings in Two Cases of Bismuth Poisoning.*

The urine of patients to whom bismuth subnitrate and bismuth subcarbonate had been administered was found to contain bismuth. It is commonly supposed that the organism does not absorb these bismuth compounds.

W. A. Withers and B. J. Ray with the collaboration of R. S. Curtiss and G. A. Roberts: *Studies on Cotton-seed Meal Intoxication.* I. *As to Pyrophosphoric Acid.*

James N. Currie: *Studies on the Flavor of the Green Mold Cheeses.*

A study of the volatile fatty acids of the green mold cheeses, Roquefort, Gorgonzola and Stilton, shows that the fat undergoes a marked hydrolysis during the ripening process. This change is doubtless accomplished by a lipolytic enzyme of *Penicillium roqueforti*, which, according to Thom, is concerned in the ripening of all of these cheeses. The characteristic peppery taste of the green mold cheeses may be, at least partially, ascribed to an accumulation of caproic, caprylic and capric acids, or their readily hydrolyzable ammonium salts.

H. P. Bassett: *Transformation of the Fruit Acid by Animal Enzymes.*

William H. Walker: *Electrical Apparatus for Use with Benedict's Method for the Determination of Urea.*

Max Kahn: *On the Absorption and Distribution of Aluminium from Aluminized Food.*

When biscuits baked with alum baking powder are fed in a mixed diet to dogs, aluminium passes in considerable amounts into the blood.

Such absorbed aluminium circulates freely and tends to accumulate to some extent in the various organs.

Aluminium is partially excreted by the liver in the bile and is also eliminated in the urine.

Charles H. Sanford and Jacob Rosenbloom: *On the Glycyltryptophan and Tryptophan Tests for Cancer of the Stomach.*

T. B. Aldrich: *On Feeding Young Pups the Anterior Lobe of the Pituitary Gland.* I.

Seven pups, five females and two males, as soon as weaned were separated into two groups *A* (4), *B* (3), weighed and fed on bread and milk only for eight days. They were then reweighed and each pup in group *A* received daily in addition to his milk and bread diet 50–75 mg. of the fresh desiccated, defatted anterior lobe of the pituitary gland; each in the other group received an equal amount of desiccated, defatted ovary. The pups were weighed usually every fourth day and the weights recorded in tables and charts. The experiment extended over nearly four months. These records show that the controls increased in weight faster than the pituitary-fed pups. One pituitary-fed pup weighed the most; but the group curve shows the controls had much the advantage. These observations are not in accord with Professor Schafer's findings, who found that the anterior lobe stimulated the growth of young rats. Further experiments are necessary to decide whether the anterior lobe has a stimulating action or not on young animals.

I. K. Phelps and C. S. Hudson: *A New Crystalline Product from Yeast.*

F. C. Weber and H. W. Houghton: *Notes on a Few Chemical Methods for the Detection of Deterioration in Flesh Foods.*

Charles B. Lipman: *The Toxic and Protective Effect of Salt as Related to Soil Bacteria.*

Burton E. Livingston: *Incipient Drying in Plants.*

When water loss from the exposed membranes of leaves occurs at a rate higher than that at which

water of imbibition enters these membranes from within, then the surfaces must begin to dry. This phenomenon, which may be termed *incipient drying*, actually occurs in leaves which are subjected to relatively high transpiration. It acts as an automatic check upon transpiration. These considerations are important in the study of the water relations of plants; they also seem to bear upon the physics and chemistry of the formation of cuticle, etc.

M. McCOOL: *The Toxic and Antagonistic Relations of Manganese.*

JOINT PROGRAM OF THE BIOLOGICAL SECTION OF THE AMERICAN CHEMICAL SOCIETY AND THE AMERICAN SOCIETY OF BIOLOGICAL CHEMISTS

THOMAS B. OSBORNE and L. B. MENDEL: *Maintenance and Growth.*

WILDER D. BANCROFT: *The Study of Environment.*

When studying the effect of environment on an organism, we must distinguish three distinct things: the direct effect of new external conditions involving no adaptation; the adaptation of the organism to the new conditions; and the possible inheritance of the adaptations. The botanists have not made these distinctions. They consider the change of curvature of tendrils with change of temperature as a case of non-adaptive response, whereas it has no more to do with adaptation than the shortening of a fishing-line when it is wetted.

The problem of the inheritance of acquired characters has been complicated unnecessarily by the arbitrary limitation that the character must be inherited for four or five generations after the organism has been brought back to the original surroundings. Since an organism which responds readily to a new environment will also revert readily when brought back, this definition has probably excluded most of the cases in which the inheritance of acquired characters could be shown. The biologists seem never to have realized that inheritance is primarily a hysteresis phenomenon and should be studied as such.

TREAT B. JOHNSON: *The Synthesis of Thiotyrosine.*

A knowledge of this new amino acid was especially desirable, in order to acquire a more definite conception of the true nature of sulphur combinations in proteins. The acid has been prepared by the application of a new, general method for the synthesis of alpha amino acids and its chemical properties are now being studied.

The most important characteristic of the acid, so far observed, is the fact that it does not give Millon's test. On the other hand, it gives, on warming the concentrated sulphuric acid, as characteristic color reaction, as the Milton's test is characteristic for tyrosine. This study is one of a projected series on new sulphur combinations which has been planned for the Sheffield Laboratory.

ALFRED DACHNOWSKI: *The Relation of Vegetation to the Chemical Nature of Peat Soils.*

C. L. ALSBERG and O. F. BLACK: *Phytochemical Studies on Hydrocyanic Acid.*

J. H. LONG: *The Definition of Normal Urine.*

Our notions as to what is a normal urine have undergone many changes in the years which have elapsed since the first attempts were made to establish standards.

The same individual, at one time on a high protein diet and again on a low protein diet will excrete urine which will be markedly different in many ways, and yet both will be normal.

Improved methods of examination have shown that hyaline casts are much more frequently present in the urine of healthy men than was suspected a few years ago, and it must be admitted that traces of albumin occur in the urine of men who, from all ordinary points of view, are perfectly well.

The statement as to what constitutes normal urine must take cognizance of these facts, and of the further fact that for each individual there seem to be agencies at work which modify the nitrogen distribution, the acidity and the natural sulfur in ways which we can not account for. In a certain sense each individual has his own standard of normality.

ANDREW HUNTER and MAURICE H. GIVENS: *The Nitrogen Excretion of the Monkey, with Special Reference to the Metabolism of Purines.*

A female monkey (*Cercopithecus callitrichus*), weighing 4.7 kilograms, was maintained for 40 days on a daily ration of 200 c.c. whole milk, 200 grams bananas and 20 grams peanuts. The urine was collected every 48 hours. For the first 16 days the average daily excretion of N was 1.83 grams, distributed as follows: urea, 1.59; NH_3, 0.028; creatinine, 0.065; allantoin, 0.015; purines, 0.0027; undetermined, 0.13 gram N: or, urea 86.9: NH_3, 1.5; creatinine, 3.5; allantoin, 0.82; purines, 0.15; undetermined 7.1 per cent. of the total N. Uric acid could not be detected.

During the remainder of the experiment attention was devoted particularly to the metabolism of endogenous and exogenous purines. On seven

normal two-day periods the excretion of allantoin N ranged from 27.0 to 31.8, that of purine N from 4.7 to 10.3 milligrams. On five periods, each interpolated between two normal ones, doses of 0.5, 0.5, 1.0, 1.0 and 2.0 grams sodium nucleate were administered. Of the purine N thus fed 90, 56, 41, 24 and 29 per cent., respectively, of the theoretically possible was recovered in the form of allantoin and urinary purines. Of the amount so recovered 79 to 98 per cent. took the form of allantoin; after the second dose of 0.5 gram 2 per cent., and after 2.0 grams 9 per cent. appeared as uric acid. In normal periods allantoin accounted for 71–87 per cent., in nucleate periods 77–86 per cent. of the total purine-allantoin N. In respect of the ratio between allantoin and purine excretion the species examined resembles the lower mammals rather than man. On the other hand, we did not meet with the almost quantitative conversion of exogenous purines into allantoin, which has been reported for the dog.

H. S. Reed and H. S. Stahl: *Oxidizing Enzymes in Certain Fungi Pathogenic for Plants.*

The oxidizing ability of the plant extract is often altered as a result of the invasion of parasitic fungi. The extracts of apples invaded by *Sphæropsis malorum* show no oxidizing powers whatever. Apples attacked by *Glomerella rufomaculans* show, on the contrary, a somewhat increased oxidizing ability. When grown in pure culture on synthetic media *Glomerella* develops oxidizing enzymes in certain media but not in others.

Waldemar Koch: *Should the Term Protagon be Retained?*

Data were presented which indicated that the preparations referred to as protagon contain at least three substances: a phosphatid containing cholin, a cerebrosid containing sugar, a complex combination of a cholin-free phosphatid with a cerebrosid to which an ethereal sulphuric acid group is attached. The term protagon can not, therefore, be said to have any chemical significance. The details will be presented in a more extended publication.

William J. Gies: *Modified Collodion Membranes for Studies of Diffusion.* (From the Laboratory of Biological Chemistry of Columbia University, at the College of Physicians and Surgeons, New York.)

Lipins and many substances which dissolve in ether, alcohol and similar solvents can be dissolved, in large proportions, in U. S. P. collodion solution. Such mixed solutions, when treated in any of the usual ways for the production of collodion membranes, yield composite homogeneous products. Lecithin, cholesterol, lard, olive oil, rubber, alcohol-ether-soluble protein, organic pigments, ferric sulfocyanate and many other substances have been incorporated homogeneously in such modified collodion membranes, which show interesting differences in permeability.

Morris S. Fine: *A Method for Differentiating between Metabolic and Residual Food Nitrogen of the Feces.* (From the Sheffield Laboratory of Physiological Chemistry, Yale University, New Haven, Conn.)

As a rule the methods previously employed for this purpose have not taken into account the fact that the indigestible materials, *e. g.*, cellulose and hemicellulose such as are present in cereals, legumes, etc., show a marked tendency to increase the elimination of fecal material. The following procedure is believed to offer certain advantages over those hitherto proposed. From the fecal nitrogen accruing from a given diet is subtracted the corresponding value resulting from a *non-nitrogenous diet, yielding practically the same amount of feces.* Such a non-nitrogenous diet may be conveniently obtained by adding agar agar to non-nitrogenous food whose calorific equivalent does not differ materially from that of the diet under investigation. The result thus obtained represents the amount of nitrogen of the latter diet which has *actually escaped utilization.*

E. Monroe Bailey: *Biochemical and Bacteriological Studies of the Banana.*

An earlier study[1] has been extended. Enzymes concerned in ripening processes have been investigated, and in addition bacteriological and chemical examinations of the fruit in various stages of maturation have been made. Amylase, sucrase, raffinase, protease, lipase and peroxidase were detected. Tests for maltase, dextrinase and lactase were doubtful or negative. The inner portions of the pulp of sound fruits appear to be sterile, but the regions of the inner coats of the peel may be sparsely inhabited by bacteria. As ripening progresses, starch disappears and the content of alcohol-soluble sugars and dextrins increases. Maltose could not be detected.

Charles L. Parsons,
Secretary

(To be continued)

[1] *Journal Biological Chemistry*, I., pp. 4 and 5, 1906.